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Construction Methods and Equipment

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February, 1938

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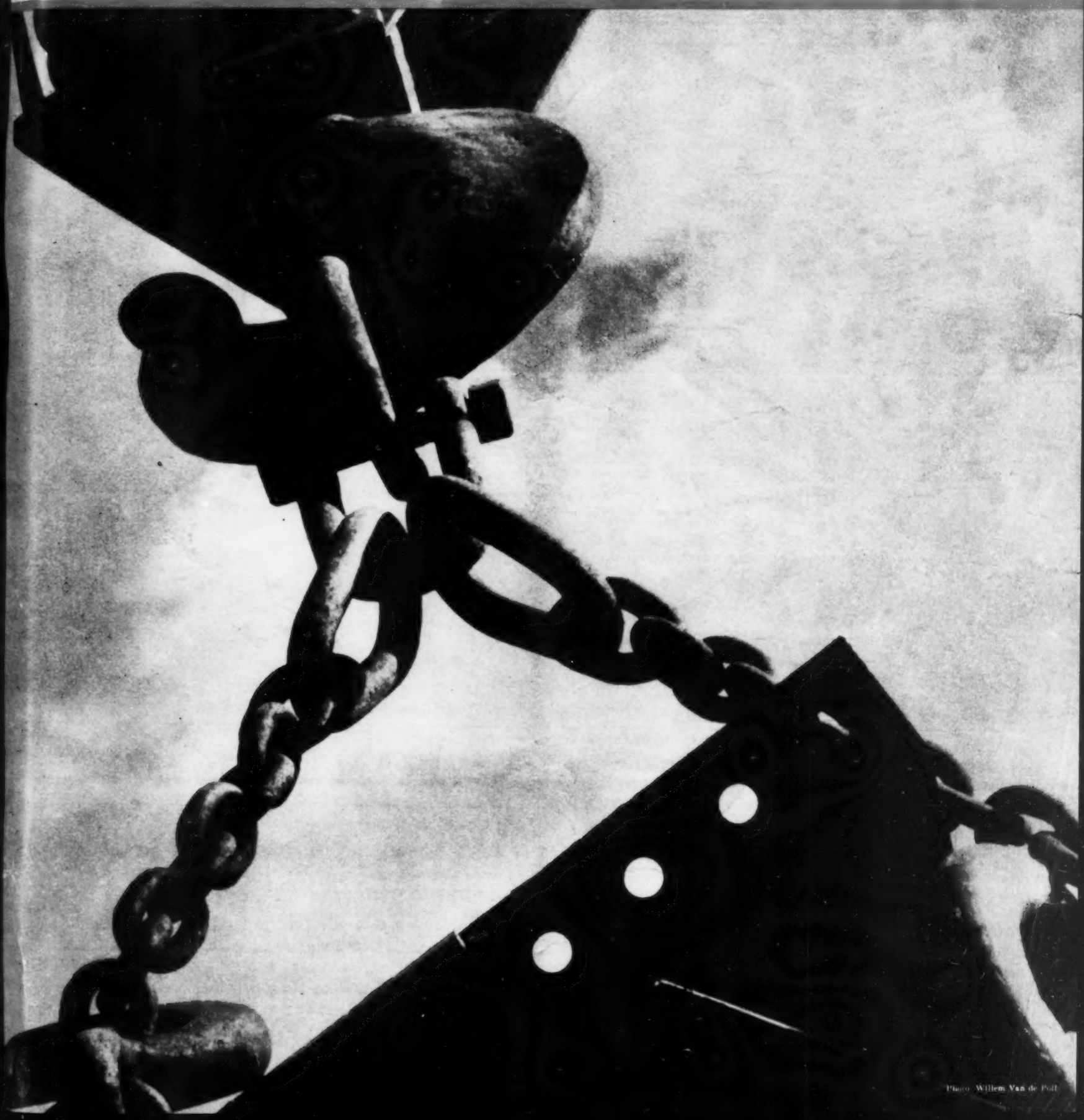

Photo: Willem Van de Poll

STRANGE SHADOWS ON *your cost sheets*

LOOK for them. What causes this item of expense or that delay in time?

Plain steel can cast some strange shadows on cost sheets when all factors affecting its use are not properly taken into consideration.

Don't think, for example, that because your specifications call merely for flat bars, plates or sheets that opportunities for worthwhile economies do not exist.

That's where they're often found when looked for by the practiced eye of the specialist. Consult an Inland engineer or metallurgist on your very next steel order. If he can save money or time, the profit is yours. In any event, you risk no expense or obligation in making use of his efforts.

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SHEETS STRIPS TIN PLATE BARS RAILS
TRACK ACCESSORIES PLATES FLOOR PLATES
STRUCTURALS PILING REINFORCING BARS

TECHNOLOGY DEPT.

CURRENT JOBS

. . . . and Who's Doing Them

SEWERS

Sewer contracts in Memphis, Tenn., were awarded to **Marsh & Wells, Inc.**, St. Louis, Mo., $426,811; to **Nolan Constr. Co.**, Detroit, Mich. (two contracts), $477,475 and $863,699. In New York City, an outfall extension was awarded to **Luang Constr. Co.**, Brooklyn, for $507,255, and contract for constructing pump and blower house at sewage treatment works was awarded to **Caye Constr. Co.**, Brooklyn, for $1,280,186.

WATERWORKS

Water distribution system for Lake, Wis., was placed under contract with **Wenzel & Henoch**, Milwaukee, Wis., on bid of $669,548. Cullman, Ala., awarded contract for constructing new water supply, estimated at $220,000, to **R. J. Reid Contg. Co.**, Birmingham, Ala. In Seattle, Wash., contract for water mains went to **Queens City Constr. Co.** for $214,327.

BRIDGES

Concrete and steel bridge at De-Funiak Springs, Fla., went to **G. D. Auchter Co.**, Jacksonville, Fla., for $613,942. At Bay City, Mich., **Owen-Ames-Kimball Co.**, of Grand Rapids, bid in concrete and steel bridge for $549,848. In St. Louis County, Mo., concrete encasement and guniting of Missouri River bridge was awarded to **Massman Constr. Co.**, Kansas City, for $509,939. **James Stewart & Co.**, New York, was awarded $769,950 contract for bridge superstructures in Queens. Contract valued at $512,530 for reconstructing bridge at Bayville, L. I., was awarded to **Andrew Weston Co.**, Woodmere, N. Y.

DAMS

Low bidders on three dams were as follows: Crooked Creek Dam, Ford City, Pa., $2,367,511 by **G. M. Brewster & Son**, Bogota, N. J.; Allegheny River dam, Tionesta, Pa., $2,624,610 by **S. J. Groves & Sons Co.**, Minneapolis, Minn.; Vallecito Dam, Pine River project, Colo., $2,117,620 by **Martin Wunderlich Co.**, Jefferson City, Mo. Contract for completing tunnel control shafts for Fort Peck Dam was awarded to **Fegles Constr. Co., Ltd.**, Minneapolis, Minn., on bid of $1,876,922. **Western Pipe & Steel Co.**, San Francisco, Calif., entered low bid of $1,456,624 for penstocks and pipe at Grand Coulee dam.

HIGHWAYS

Work on New Jersey approaches to Lincoln Tunnel under Hudson River went to **G. M. Brewster & Son, Inc.**, New York City, $1,340,375, and to **B. Perini & Sons**, Framingham, Mass., $733,273. Other important highway contracts have been awarded as follows: New Jersey, $594,582 and $102,979 to **Franklin Contg. Co.**, Newark. California, $895,045 to **Healey-Moore Co. and Fredrickson & Watson Constr. Co.**, Oakland; and $461,075 to **Griffith Co.**, Los Angeles. Indiana, $277,205 and $125,495 to **Calumet Paving Co.**, Indianapolis. Pennsylvania, $391,737 to **H. W. Shaull & Sons**, Mechanicsburg. Virginia, $387,678 to **R. E. Mills Co.**, Frankfort, Ky. South Carolina, $367,966 to **Wesco Co.**, Chattanooga, Tenn. Texas, $157,484 and $138,604 to **J. S. Moore & Sons**, Lufkin. Section of Blue Ridge Parkway in North Carolina was awarded by U. S. Bureau of Public Roads on bid of $479,947 to **Chandler Bros.**, Virgilina, Va.

BUILDINGS

Public — Among contracts awarded by Commonwealth of Pennsylvania in its public building program were following: to **McCloskey & Co.**, Philadelphia, general contracts for psychiatric hospital, Pittsburgh, $1,464,000, and for Farm Show arena, Harrisburg, $912,000; to **J. McShain**, Philadelphia, hospital buildings, Harrisburg, $567,200. In Phoenix, Ariz., **D. E. Webb Construction Co.** will build new wing on state capitol building for $443,548. **J. H. Jones Construction Co.**, Charlotte, N. C., holds contract valued at $1,169,375 to build hospital additions in Chattanooga, Tenn. At Houston, Tex., **R. F. Ball Construction Co.**, Fort Worth, Tex., received $1,266,683 contract for construction of city hall. General contract for state school at Buckley, Wash., was awarded to **S. C. Ericksen**, Tacoma, Wash., on bid of $397,867. High school in Detroit, Mich., will be built by **F. R. Patterson Engineering Co.** under $665,937 contract. Postoffice substation in New York City is to be constructed by **J. Weinstein & Rubin Building Corp.** under contract valued at $573,433. Contract for National Institute of Health Building, Bethesda, Md., was awarded to **G. A. Fuller Co.**, Washington, D. C., on bid of $986,950.

Industrial — At Youngstown, Ohio, Republic Steel Corp. has awarded contract for coke ovens estimated to cost $1,250,000 to **Koppers Co.**, Pittsburgh, Pa., and blast furnace contract estimated at $800,000 to **W. B. Pollack**, Youngstown. In nearby Warren, Ohio, **National Concrete Fireproofing Co.**, Cleveland, is building for General Motors subsidiary factory building to cost about $400,000. Four mill buildings at Middletown, Ohio, estimated at $620,000, have been awarded by American Rolling Mill Co. to **F. H. McGraw Co.**, Middletown. A rayon process mill estimated to cost $1,000,000 is under construction at Fernandina, Fla., by **Rust Engineering Co.**, Pittsburgh, Pa., for Rayonier Mills. Ford Motor Co. has awarded contracts aggregating about $2,350,000 for steel sheetpiling and structural steel for plant extension at Dearborn, Mich., to **Carnegie-Illinois Steel Corp.** and **American Bridge Co.**, Pittsburgh, Pa. At Curtis Bay, Md., **DuPont Engineering Co.**, Wilmington, Del., is erecting sulphuric acid recovery plant estimated to cost $2,000,000. In Kansas City, Mo., **Kansas City Power & Light Co.** has awarded separate contracts for $3,200,000 power plant. A refinery plant unit estimated to cost $1,200,000 is being built at Port Arthur, Tex., for **Gulf Oil Corp.**, Pittsburgh, Pa.

Commercial — In Minneapolis, Minn., **Walter Butler Co.** and **Fleisher Eng. & Constr. Co.** are preparing to build housing groups estimated at $1,000,000 each. **McCullon Constr. Co.**, Bartlesville, Okla., will build $700,000 apartment house in that city. In Newark, N. J., **C. F. MacEvoy** will build $1,500,000 apartment house. A group of 90 individual houses aggregating $540,000 is being constructed at North Arlington, N. J., by **E. Skold.** At Charlotte, N. C., **F. N. Thompson** has been awarded contract valued at about $600,000 for an apartment house. **Bergdorf Constr. Co.**, Cincinnati, Ohio, is letting separate contracts for $700,000 development involving 100 residences. General hospital contract at Schenectady, N. Y., went to **J. E. Lowe & Sons Co.** for building estimated at $650,000. In Yonkers, N. Y., **H. R. Mooney**, Larchmont, plans to build 200 residences valued at about $3,000,000.

Construction Methods and Equipment

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WILLARD CHEVALIER, Vice-President

FEBRUARY, 1938

The "How" of it

For the benefit of readers concerned with the practical application of method or equipment the following references are to articles or illustrations in this issue that tell:

How VERTICAL RISER of submarine water main was constructed in sheetpile cofferdam. — p. 37
How FOUR COST FACTORS were analyzed to find cheapest winter concreting method. — p. 40
How HIGH-EARLY-STRENGTH CEMENT cut cost of concrete floors on winter job. — p. 41
How STEEL FRAMEWORK supported extended paver booms making 5,600-cu.yd. monolithic pour. — p. 42
How CIRCUS TENT covering hole eliminated danger of rain interruptions during 60-hr. pour. — p. 44
How FACING STONE served as outside form in concreting tall shaft. — p. 44
How HEAVY STEEL COFFERDAM permitted excavation of large hole close to river. — p. 46
How GRAVEL LAYER and underdrains provided dry bottom for concrete footing mat. — p. 48
How WELDED CONNECTIONS simplified remodeling of steel frame. — p. 52
How SPECIAL LIFTING BEAM enabled two 350-ton cranes to handle 630-ton load. — p. 55
How SIX-TRACK CABLEWAY moved 125-ton loads to power house. — p. 56
How ROTARY WET CAISSON DRILL sank holes for deep foundations in unstable soil. — p. 57
How LIQUID MUD in drilled hole supported walls until steel shell was placed. — p. 57
How TWO KINDS OF TRAVEL PLANTS mixed cutback asphalt and sand for pavement. — p. 58
How ONE TRAVEL PLANT metered bitumen and aggregates by volume. — p. 58
How OTHER TRAVEL PLANT controlled bitumen content of mixture. — p. 59
How WELDED STEEL I-BEAM ARCHES eliminated posts and columns in automobile service station. — p. 59
How BOLTING MACHINES speeded progress in connecting cast-iron tunnel lining segments. — p. 60
How LEAN-MIX CONCRETE BLOCKS served gutter and revetment purposes. — p. 61
How TRACTOR-POWERED WINCH pulled electric cable through conduit. — p. 61
How HYDRAULIC LIFT on truck picked up rock skip. — p. 61
How LOW VOLTAGE COFFERDAM PUMPS have prevented accidents to men. — p. 62
How STANDARDIZATION OF SIZES in transformers has proved advantageous on construction jobs. — p. 63
How INTERCHANGEABLE MOTORS have simplified substitution and maintenance. — p. 63
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How CENTRAL CONTROL STATIONS have been equipped to indicate operating condition of motors. — p. 65

ROBERT K. TOMLIN, Editor — A. E. PAXTON, Manager

Editorial Staff: Vincent B. Smith, Paul Wooton (Washington), Nelle Fitzgerald

Respectfully Referred to Congress

ON THE EVE of the Cleveland Convention and Road Show of the American Road Builders' Association, its Engineer-Director received the following letter. It is printed just as it was written except for the removal of identifying data. It indicates the direct effect of any slash in the Federal Aid to Highways such as has been recommended by the President to Congress. It is referred, therefore, without comment, to the Roads Committees of the Senate and of the House of Representatives.

Mr. Chas. M. Upham,
Engineer-Director,
American Road Builders' Association,
Cleveland, Ohio

Jan. 10, 1938

Dear Sir:

The biggest convention and road show in history will swing open its doors in a few days to receive the road builders from every corner of this great country and from many foreign lands. For those who are fortunate enough to attend there will be a great merging of minds, resulting in a new understanding of better methods, better products, better machines and better roads.

I regret that I cannot be in Cleveland to share in this acquisition of new ideas. Only yesterday an order was received at our job where I have been employed as Road Engineer, withdrawing all remaining road funds of the present fiscal year. So my job, and that of many other highway engineers, road foremen and operators of road building equipment is wiped out. For what reason, I do not know. Of course, I appreciate the fact that many thousand workers have also lost their jobs. *While the federal government is questioning the right of industry to reduce forces, advising the continuation of production, this same government is in the act of abolishing jobs by a withdrawal of road funds.*

For the duration of the convention you will probably be the busiest man on earth. It seems unfair for me to ask that you interest yourself in the problem of those who are being dropped from the payroll everyday. But should you be able to spare a few minutes, and should you find the opportune time to say a word which might help to stop the policy of laying off additional highway engineers and construction men by the federal government, I am sure that your action would be appreciated. *Should you be able to convince the powers that be that this is the time for the federal government to retain their employees as well as preach this policy for industry,* it is possible that a real forward movement might be inaugurated in the road building industry which would lead the way to a general recovery in all lines. This would be the true function for road building to assume, as all industry and commerce, to say nothing of the movement of the armed forces of the nation in time of war, must follow the road; they could not possibly precede it.

With best wishes for a convention of outstanding accomplishments, I remain

Very truly yours,

(The italics are by this writer.)

Willard Chevalier

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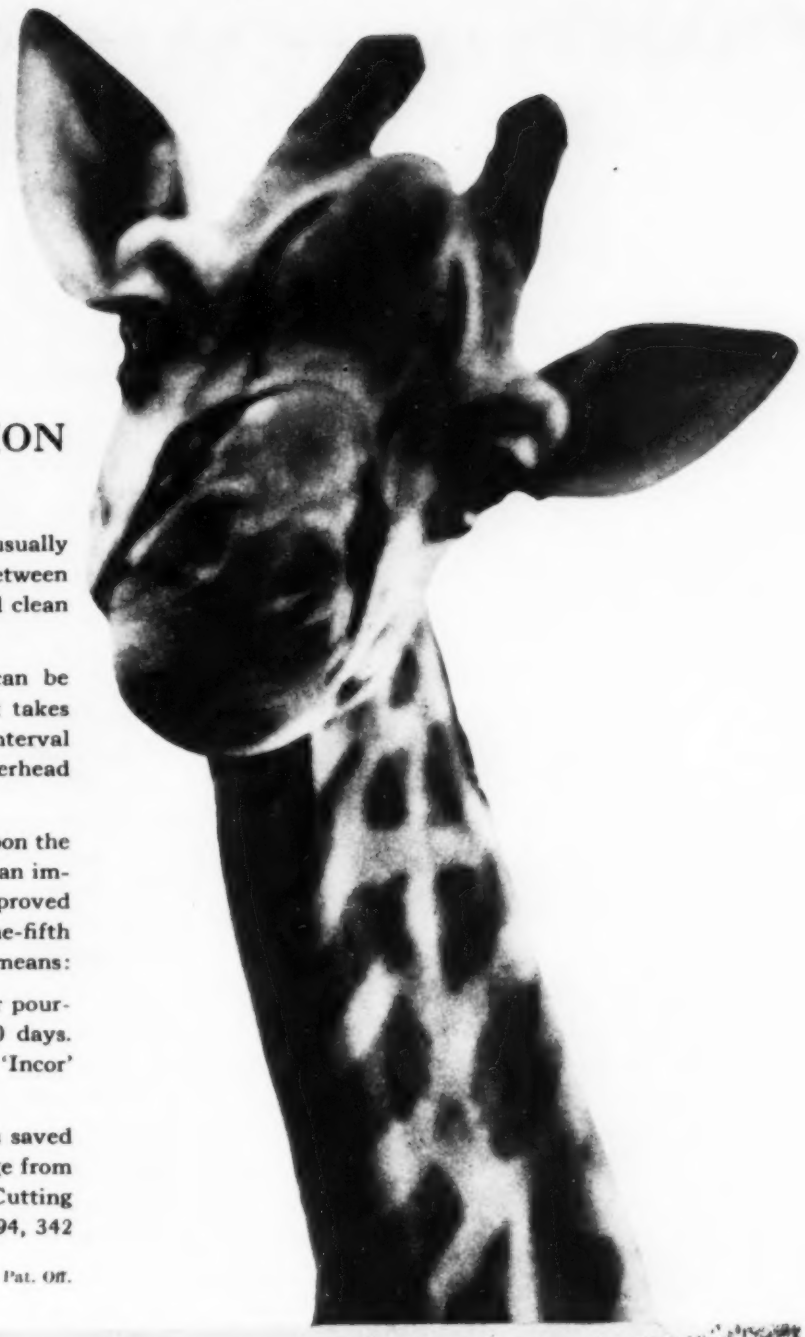
STRETCHING DOLLARS

IN CONCRETE FRAME ERECTION



CONSIDER the cost of time and forms. Contractors usually form in units which can be concreted in one day — between starting time and mid-afternoon, so as to finish concrete and clean up without overtime.

After forms are filled, the job is tied up until forms can be stripped and re-assembled. That depends upon how long it takes the concrete to become self-supporting. The longer this interval of non-productive time, the higher the cost, because overhead runs on steadily.

The length of this non-productive time interval depends upon the kind of cement used. Which explains why 'Incor' plays such an important part in cutting costs. Because 'Incor', a basically improved Portland cement, cures 5 times as fast, is self-supporting in one-fifth the usual time. On a 6-story building, for example, that means:

With a 5-day week, 5 days for form assembly, one day for pouring, one day for curing — completion in 36 days, saving 20 days. On new Giraffe House for Chicago Zoo, shown below, 'Incor' actually saved 6 weeks.

Figure it out: If job overhead is $50 a day, even 20 days saved means $1,000. On typical 'Incor'* jobs, net savings often range from 45 cents to $1.22 a cubic yard of concrete. Write for copy of "Cutting Concrete Costs." Lone Star Cement Corporation, Room 2294, 342 Madison Avenue, New York.

*Reg. U. S. Pat. Off.

LONE STAR CEMENT CORPORATION

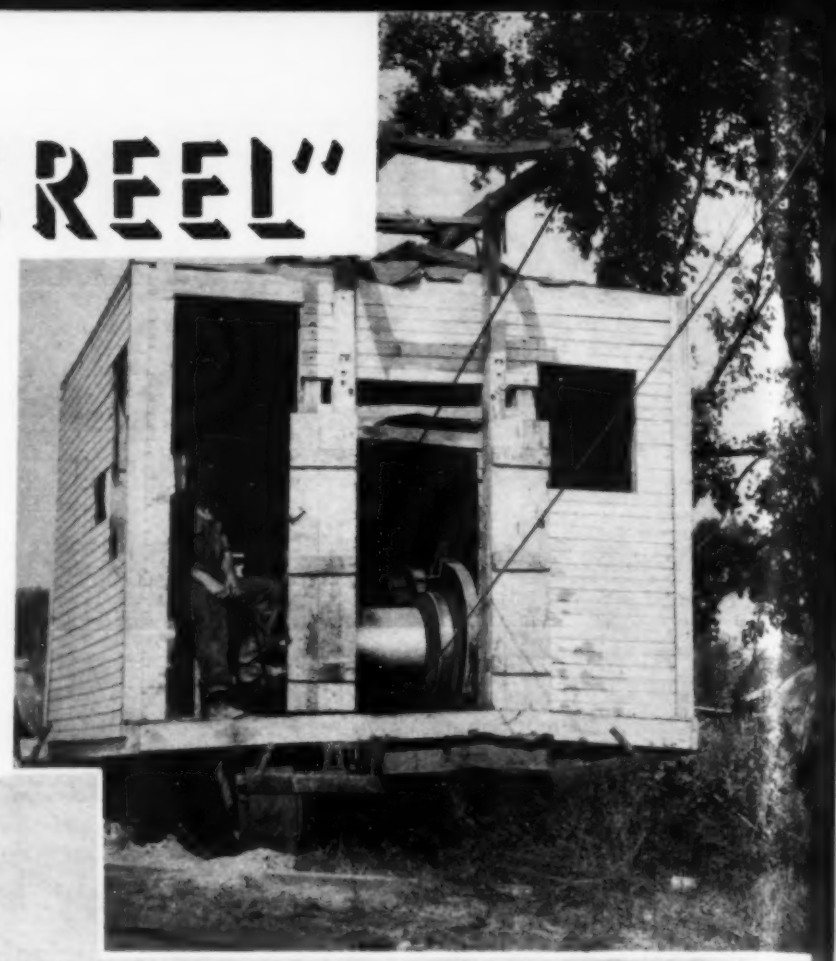
MAKERS OF LONE STAR CEMENT...'INCOR' 24-HOUR CEMENT

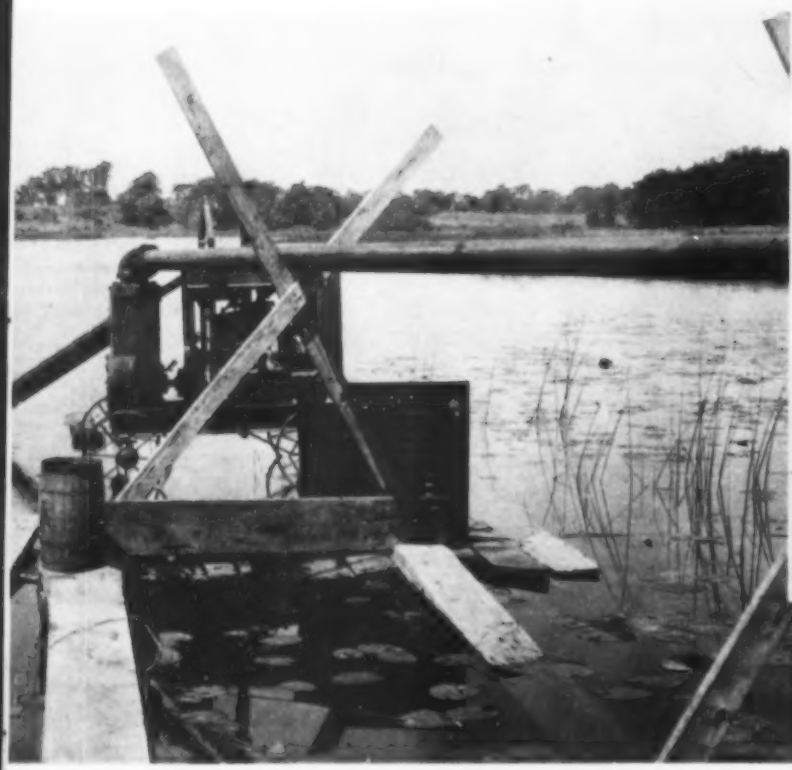
This Month's

NOVO "NEWS REEL"

VETERAN HOIST (right) — Another veteran that has been taking it for 13 years is this Novo 40 H.P., 2 drum hoist. On construction, dragline, and now on slackline cable way work for C. R. Harrman at Bryan, Ohio. It handles a ½ yd. bucket which loads to ¾ yards — over a 400′ span to the top of the screening plant. The operator, E. L. Brown, who is a veteran in hoist experience, although not in years, says, "That's the best dog gone hoist I ever operated." — Send the coupon for hoist literature.

FLOATING PUMP (below) — This Novo 6″ Self-Priming Centrifugal Pump had to all but learn to swim on this job. It is being used by the State Highway Dept. in a swampy section to supply water to a large Novo Jetting Pump one mile away on Route #59 near Pontiac, Mich. The highway fill here is being settled by jetting out the peat and marl under the fill by using 60 or more jetting points.



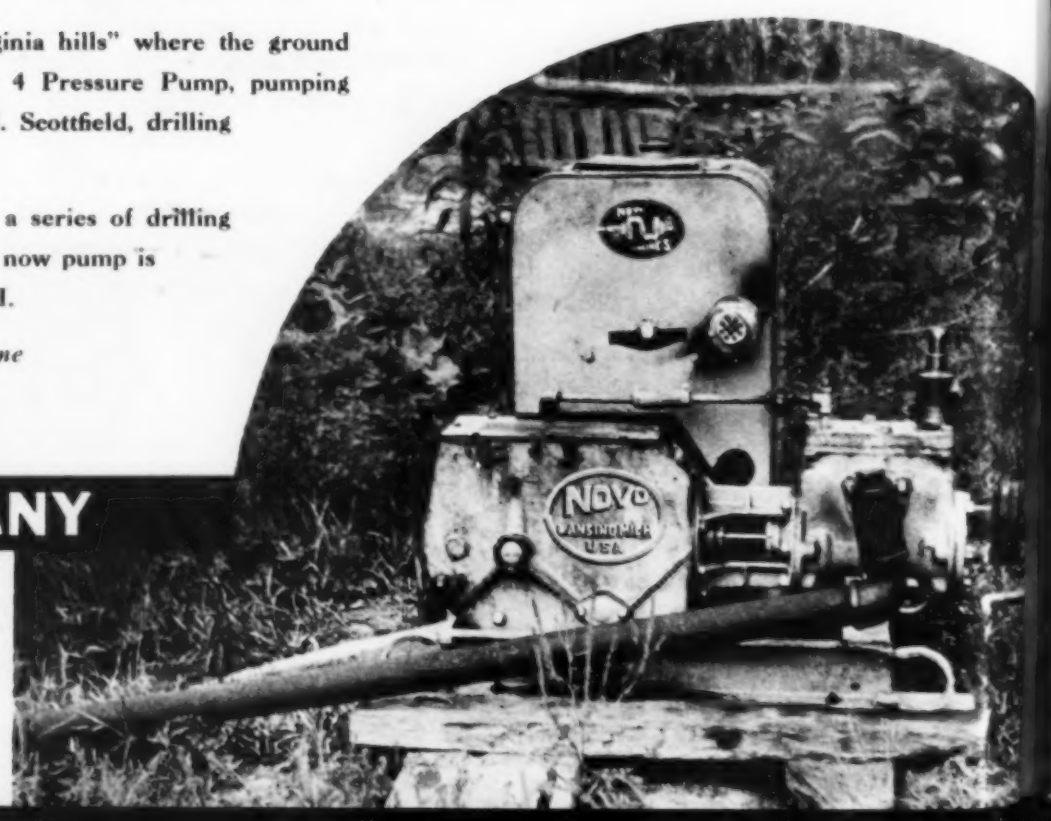


(Above) C. R. Harrman Gravel Plant at Bryan, Ohio, on which the above mentioned Novo Hoist is used.

IN THE HILLS (right) — "Among those West Virginia hills" where the ground is rough and the pumping is tough, is this Novo 3 x 4 Pressure Pump, pumping water up to the gas well drilling operations of W. H. Scottfield, drilling contractor of Glenville, W. Va.

Water is pumped from a creek in the background to a series of drilling operations, each location being farther up the hill until now pump is working against a 350′ head and is furnishing 1500 GPH.

Send for literature on this most complete line of contractors' Pressure Pumps.



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SHOVEL • DRAGLINE • CLAMSHELL • CRANE • DRAGSHOVEL

FAST, powerful, compact, the 29-B adds an important new machine to Bucyrus-Erie's world-famous line of modern excavators. High-speed digging, swinging and dumping are synchronized in the 29-B for a smooth cycle with fast acceleration, quick stops and accurate control. "Speedlined" power rides directly to the dipper teeth on anti-friction bearings through a straight-line gear train and two-part hoist. Longer upper boom section and big boom-point sheaves give better digging angles; longer rope wear. A simple, direct-action chain crowd insures a positive, powerful thrust that cuts big bites from the bank. Through the new type center pintle with special thrust washer, the propelling shaft delivers ample power for quick moves. This up-to-date one-yard winner is a machine worth knowing — write today for detailed, illustrated specifications.

•

Gasoline, Diesel or electric power. Shovel uses 1-yard welded, cast V-front, inserted-tooth, curved door dipper. With standard boom combination at 45°, maximum cutting radius 31'6"; clear dumping height 17'6"; working weight 65,000 pounds. High-speed independent live boom hoist available. Crane rating at 12' radius is 31,900 pounds. Draglines and clamshells usually use 1-yard buckets and booms 40 to 55 feet. Electro magnet for crane available.

•

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Excavating, Drilling, and Material Handling Equipment

Building Roads or Digging Cellars

(*Above*) With one tractor ripping, and two others scraping, these three DG Cletracs are moving almost 1,000 yards of dirt and rock a day in Douglas County, Colorado.

(*Below*) Two Model BD Cletracs digging a cellar with the Cletrac Front End Loader and Scarifier. The scarifier in back rips up the ground. The loader in front picks it up. Dirt moves fast — economically.

Cle

REG. U.S. PA

Crawler T

GASOLINE OR

Built To

You do more for less with Cletracs

(*Below*) Gary, Indiana was formerly a collection of sand dunes. When another street is needed, this Cletrac and nothing else starts in and pushes the dunes into the valleys and levels up the ground.

(*Left below*) Here's the new Model AD, the first small Diesel tractor of 28 horsepower, handling a 7-foot scraper. This outfit is using only 1.6 gallons of low-cost Diesel fuel per hour on a heavy load.

Put a Cletrac on the job and almost invariably you'll find that it does more work and costs less to operate.

There are many reasons for this. All Cletrac Diesels and the larger gasoline models have electric starting. Cletracs get on the job faster in the morning. Should they stall, it's only a question of pressing the starter button and they're going again.

With their controlled differential steering, Cletracs are pulling on both tracks at all times. They handle larger loads on the turns. You can load heavier . . . move more dirt in a given number of loads.

On bulldozing, trailbuilding, snow removal and other off center loads, it's easier to balance load and tractor when you have Cletrac controlled differential steering . . . you do a smoother, straighter job.

Now add the balanced design of the Cletrac and the saving of weight it makes possible. The result is you have greater traction in difficult conditions, larger loads on the hills and grades, more energy spent in moving loads, less in moving the tractor.

Check all these points. Check Cletrac construction . . . the sturdy side frames, the engine frame, built-in protection, the simplicity, the ease of handling. Check Cletrac fuel consumption . . . check ease of maintenance. Check all these things. You'll choose Cletracs. There's a size for every job — 22 to 94 horsepower, either gasoline or Diesel.

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This 62-ft. sperm whale, weighing 65 tons, harpooned off the coast of Southern California by the oldest whaling captain in American service, was transported on two 50-ton capacity trailers from San Pedro harbor for public exhibit at Hollywood.

Texaco Marfak protects parts twice as long as ordinary grease. Its tough, adhesive and cohesive film cushions heavy road shocks, seals out dust, resists washing out by road water.

65 TONS *ON* MARFAK

TRANSPORTING A 65-TON SPERM WHALE is not an every-day occurrence with this trucking company, but when the job comes along, Belyea delivers.

Operating from many yards scattered throughout the State of California, the heavy trucking and trailer equipment of the Belyea Truck Company is kept in service for "dependable delivery," with dependable lubrication. All wheel bearings and chassis parts are lubricated with Texaco Marfak.

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It is simple, rugged, and embodies the essential features of Northwest larger pull-shovels which have always been recognized as the standard of the industry. If you are figuring on a ditch job, get full details before you buy.

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RPM

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Approved by
CATERPILLAR TRACTOR CO.

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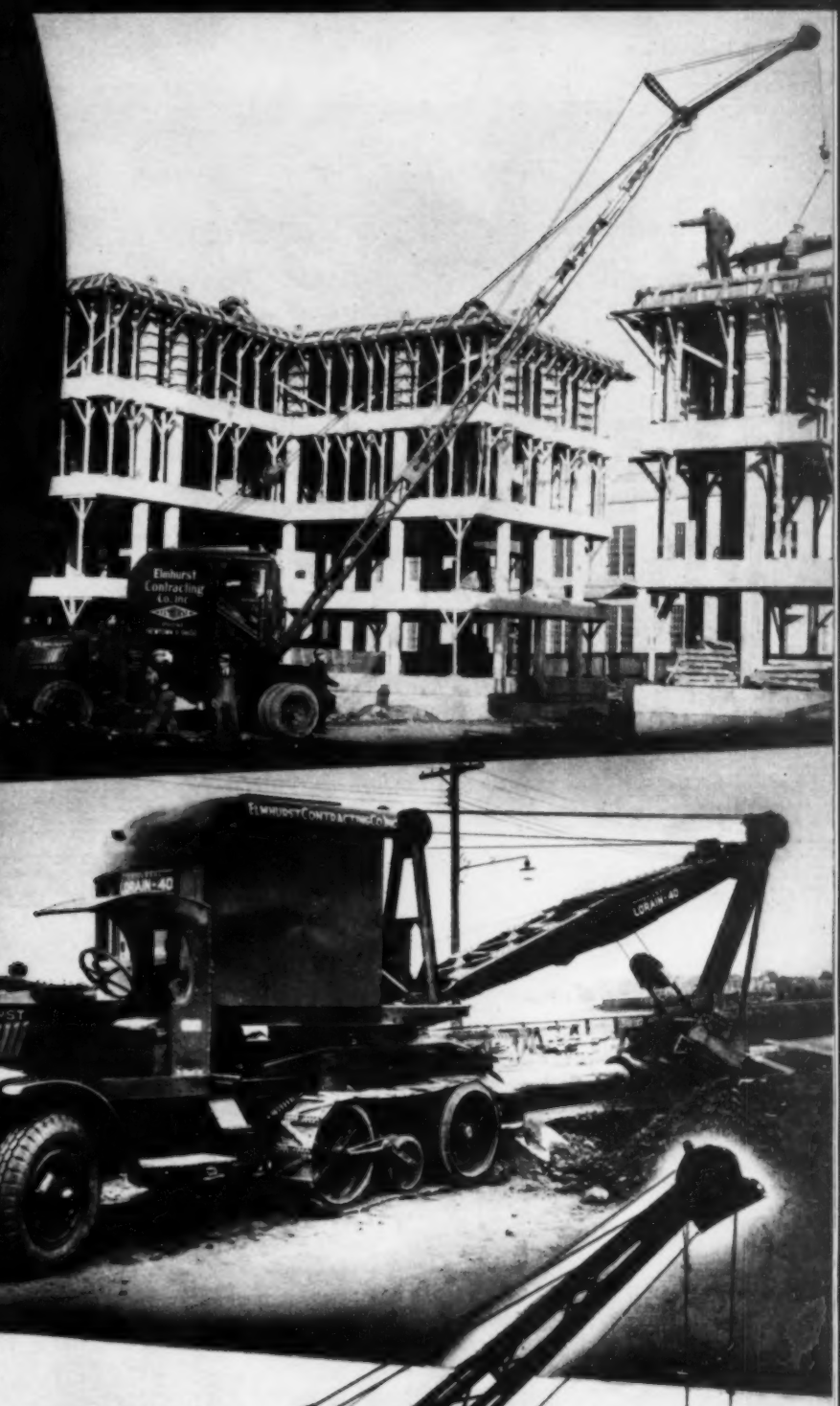
• Here's a blanket endorsement of Lorain performance that has had few equals in the contracting field. Regardless of the size or type of unit their work has required, Elmhurst have chosen repeatedly from the Lorain line of 3/8 to 2-yd. machines. At the right are pictured four of their forty 3/4-yd. Lorain-40 crawler and truck mounted units. To the left is part of their fleet of 1 1/2-yd. Diesel Lorain-77's.

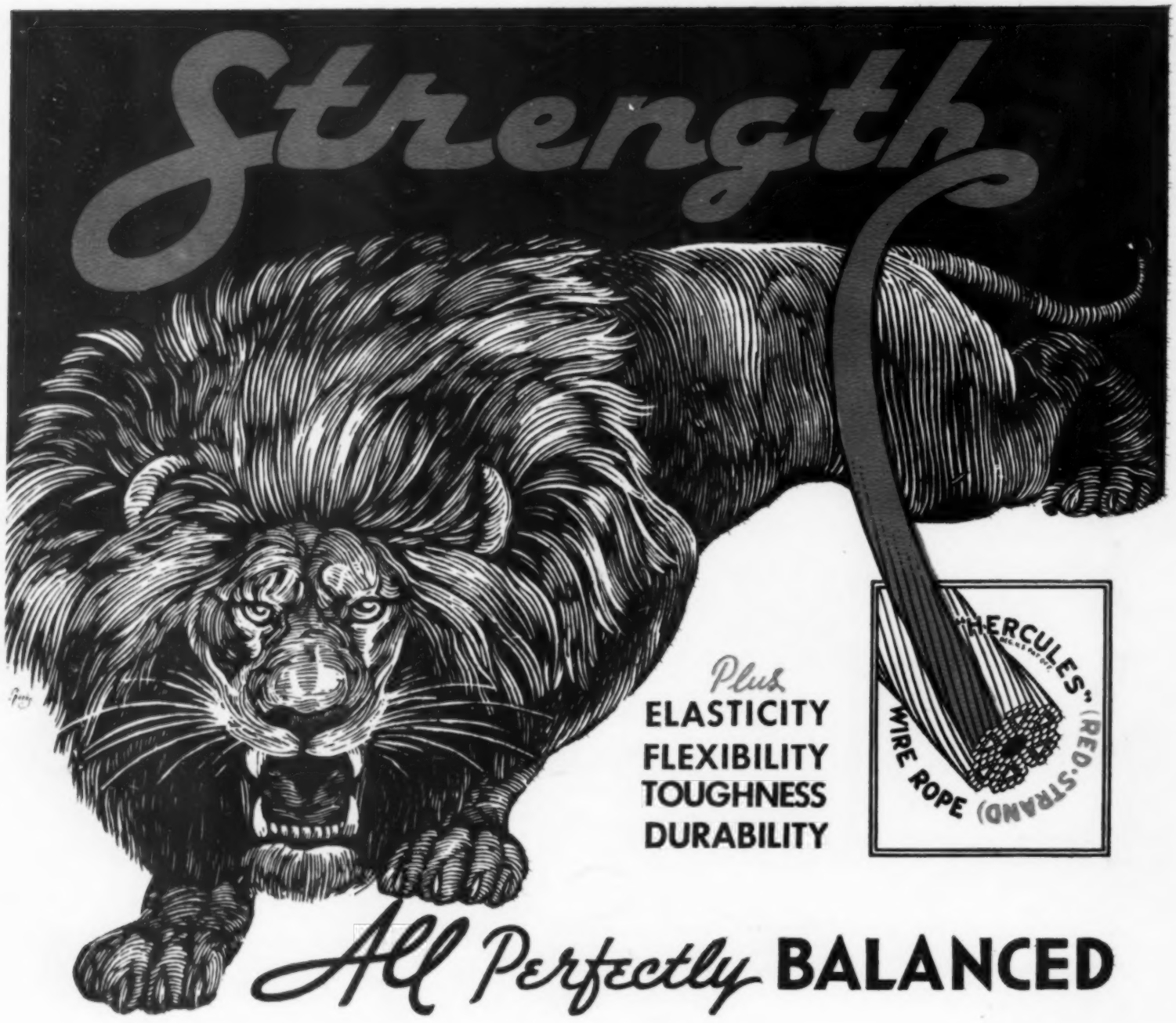
Lorains have won the unqualified acceptance of this successful contractor because every unit, due to basic Center Drive design, gives the maximum performance in its class. You, too, can increase your profits by selecting Lorains for your 1938 operations. Write today specifying type and size of machine you are interested in. Complete catalogs will be sent you promptly.

THE THEW SHOVEL CO.
LORAIN, OHIO



THEW CENTER DRIVE
REG. U.S. PAT. OFF.

Strength



Plus
ELASTICITY
FLEXIBILITY
TOUGHNESS
DURABILITY

All Perfectly BALANCED

Strength alone does not make the Lion "King of the Beasts."

For Maximum Efficiency in Preformed Wire Rope, Use . . .
PREFORMED
"HERCULES"
RED-STRAND
WIRE ROPE
Available in Both Round Strand and Flattened Strand Constructions
*Reg. U. S. Pat. Off.

"HERCULES" (Red-Strand) Wire Rope offers more than the strength necessary for the most gruelling work, because we have learned from experience that more than strength is necessary.

We protect the strength built into "HERCULES" (Red-Strand) with these other essentials—toughness . . . flexibility . . . durability . . . and elasticity—all kept in perfect balance. A method we have evolved during our eighty years of manufacturing experience.

In "HERCULES" (Red-Strand) you *always* get ALL FIVE, properly balanced for maximum performance. The wire rope of real economy.

WIRE ROPE MAKERS

A. Leschen & Sons Rope Co.

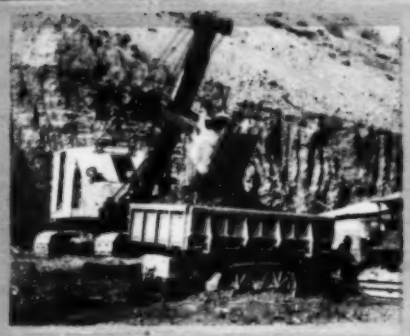
ESTABLISHED 1857

5909 Kennerly Avenue, St. Louis, Mo.

New York.....90 West Street
Chicago.....810 W. Washington Blvd.
Denver.....1554 Wazee Street
San Francisco.....520 Fourth Street
Portland.....914 N. W. 14th Avenue
Seattle.....2244 First Avenue South

Don't Be "IN THE DARK" About Hauling Expense

—Protect Profits by Checking Your HIDDEN HAULING COSTS



NO HIDDEN LOADING COSTS

Athey Forged-Trak 2-Way Dump Trailers are easily and quickly manipulated directly up to the loader regardless of spill. No extra costs to prepare a roadway to the loader—no necessity for frequent cleaning up of spill by loader or by use of auxiliary equipment.

NO HIDDEN ROADING COSTS

Athey Forged-Trak 2-Way Dump Trailers never "tear up" the road—require no extensive road preparation, no road maintenance crew to make them efficient. The Athey Forged-Trak Wheel is built to eliminate the extra costs of shortened wheel life caused by sharp rocks, jagged roots, frozen chunks of dirt, slippage and overload caused by uneven roadways.

NO HIDDEN DUMPING COSTS

Athey Forged-Trak 2-Way Dump Trailers dump on the run—over the edge of the fill—dump fast and clean, either to left or right. They eliminate time lost in maneuvering for position to dump—reduce to a minimum the necessity for auxiliary equipment to maintain the dump.

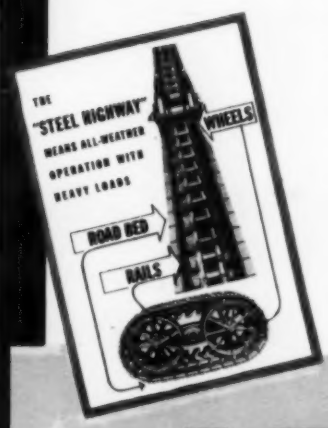
NO HIDDEN WEATHER COSTS

Athey Forged-Trak Wagons and Trailers are all-year equipment—built for your kind of work. They carry your loads over mud, snow, frozen earth, rock—without delay—without layoff.

Athey Forged-Trak equipment has the most accurately predeterminable life under a given set of job conditions of any hauling equipment. See your "Caterpillar" Dealer or write us direct.

ATHEY TRUSS WHEEL CO.
5631 WEST 65th STREET, CHICAGO, ILL. Cable Address: "Trusswheel," Chicago

On any job, Hidden Hauling Costs—the costs you didn't expect—can cut down your profit. That's why it is important to use hauling equipment that does not pile up expensive "extras" . . . equipment that eliminates these costs *because it surmounts the hazards which cause them.* And that's why so many contractors are using Athey Forged-Trak hauling units, pulled by "Caterpillar" Diesel Tractors—for Athey Forged-Trak equipment imposes NO extra costs.



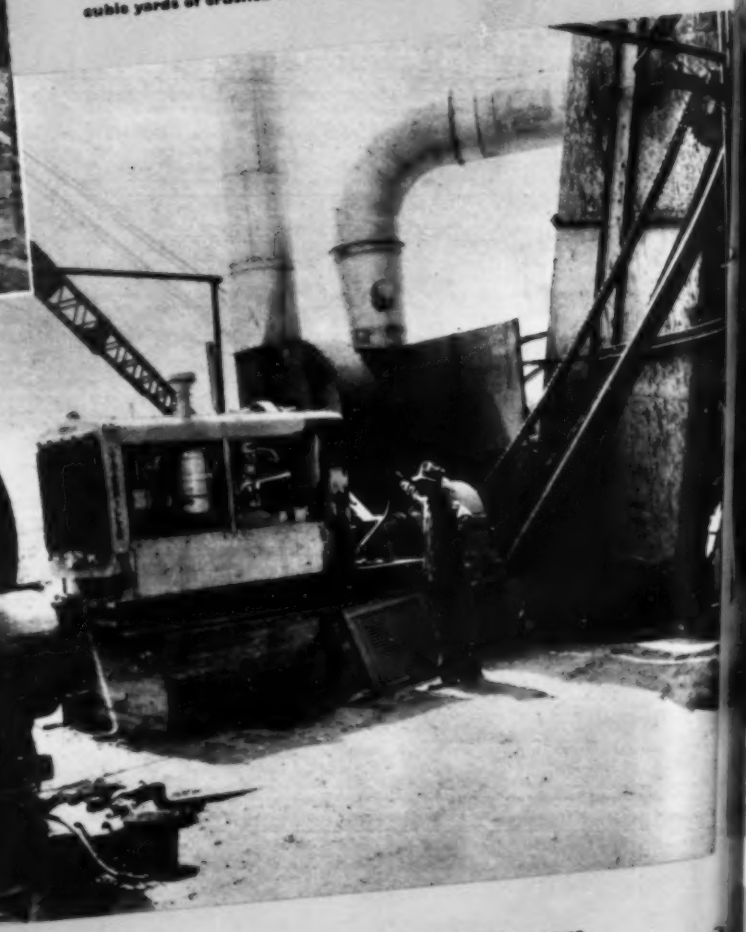
ATHEY Forged-Trak

Reg. Trade-Mark

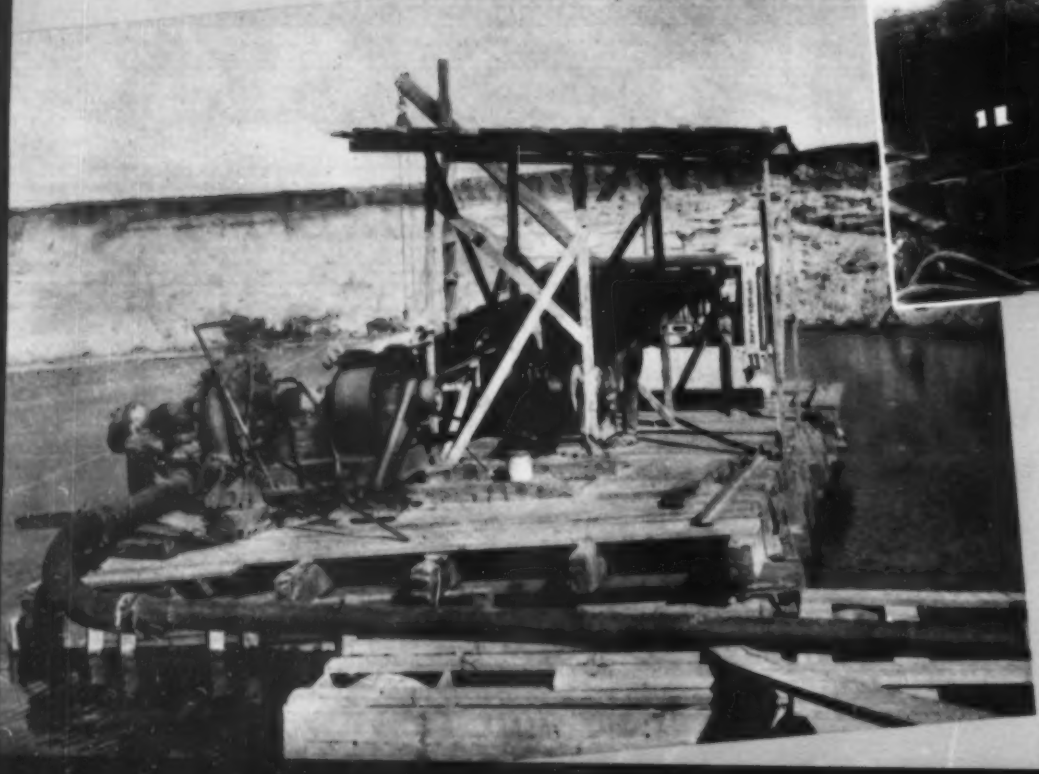
2-WAY DUMP TRAILERS

SHOVEL USES ONLY 2½ TO 3 GALLONS OF LOW-COST FUEL PER HOUR with "Caterpillar" Diesel Engine. The "Speeder" shovel is cutting back high banks for State Highway Department, near Basin, Wyoming. Outfit digs and loads 500 cubic yards per 8-hour day.

ROCK CRUSHER SAVES $10.93 A DAY in power costs. Near DePere, Wisconsin, two 80-horsepower "Caterpillar" Diesel Engines drive two crushers, two conveyor belts, bucket elevator, revolving screen, etc., on a total consumption of only 42 gallons of Diesel fuel per 8-hour day. They replaced two gasoline engines which consumed 100 gallons over the same period. Output, 50 cubic yards of crushed limestone per hour.



OIL-MIX PLANT POWER COSTS ONLY 35¢ AN HOUR—the fuel cost of two 125-horsepower "Caterpillar" Diesel Engines. One of the engines, driving a "Standard Steel Works" plant, ran more than 4000 hours without a penny of maintenance expense. The other, added later, runs conveyors, blower fans, dust collectors, air compressor, aggregate bins, a drying kiln and a small generator. Output, 150 tons per hour. Owners, Rock Road Construction Co., Chicago.



SAND-AND-GRAVEL PUMP SAVES $10 A DAY in power costs. Near Bentley, Kansas, this 125-horsepower "Caterpillar" Diesel Engine operates a 6-inch pump at a fuel-and-lubrication cost of only 29¢ an hour—a saving of fully a dollar an hour over type of power formerly used. Output is 300 cubic yards of sand per 10-hour day.

Economical
ROAD BUILDING—
from every angle!

Find a way to lower operating costs all along the line of construction and material production and you effect a combined saving that is tremendously worth-while.

Where can the construction industry make such decisive, multiple savings? *In power costs*—with "Caterpillar" Diesels. . . . (a) In the preparation of materials—in powering sand-and-gravel pumps, rock crushers, oil-mix and asphalt plants; (b) In the preparation of road beds—in powering air compressors, shovels for rock work, tractors-and-scrapers, tractors-and-graders, tractors-and-wagons, Auto Patrols.

The economy of Diesel power, as perfected by "Caterpillar," is no small thing. The proportionate *saving* ranges from one-fourth to three-fourths of the fuel *cost* of other types of power. Let's look at some records—in the case example herewith.

CATERPILLAR TRACTOR CO., PEORIA, ILLINOIS

Leading machinery and equipment manufacturers power their products with "Caterpillar" Diesel Engines. Sales and service facilities throughout the world.

CATERPILLAR DIESEL POWER

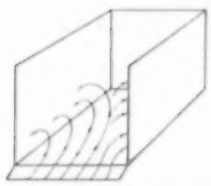
DIESEL ENGINES • TRACK-TYPE TRACTORS
ROAD MACHINERY

The Hit of the Show

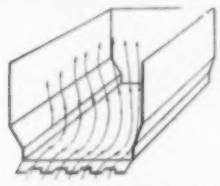
LAPLANT-CHOATE MEANS Lower Costs

Hydraulic CARRIMOR Scrapers

LAPLANT-CHOATE Loads Larger Loads because it is Scientifically designed to Reduce Loading Resistance

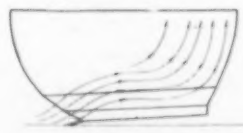


In a conventional straight side bowl, the material compresses against the sides and then bulges the load upward. This creates loading resistance.



Material entering the LaPlant-Choate "Carrimor" bell-shaped bowl hits flared side of pan which rolls it upward. Sloped sides assist tractor power in lifting material to greater height.

Conventional pan design necessitates loading material against an incline which adds to resistance and seldom fills the upper rear part of the bowl.



"Carrimor" pan loads and lifts on a plane virtually parallel with the ground. Material flows easily to back of the pan first and actually boils over the back as the front is being loaded. Requires less power to get a full load.

Your experience in earth moving operations shows your need for a scraper that digs and carries larger loads with no additional tractor power. LaPlant-Choate, a pioneer in designing and building earth moving machinery, has met that need. The new "Carrimor" scraper with the scientifically designed bell-shaped bowl that cuts loading resistance, enables you to do more work with fewer operations. Because the "Carrimor" digs and carries a peak load on every trip, it saves you time and money. Positive hydraulic control assures instant, rigid down pressure for digging and effortless operation for carrying and dumping. Available in three sizes: 3-4 yard capacity for use with "Caterpillar" D-4 . . . 5-6 yard capacity for "Caterpillar" D-6 . . . 7-8 yard size for "Caterpillar" D-7. Write for free circular giving complete details.

ROADBUILDERS
SNOW PLOWS
TAMPING ROLLERS

LA PLANT-CHOATE MANUFACTURING CO. Inc.

BULLDOZERS
BRUSH CUTTERS
RUBBER WHEEL WAGONS

CEDAR RAPIDS, IOWA.

IDAHO'S DECOMPOSED GRANITE

Licked By

TRIANGLE CONSTRUCTION CO.

Cutting a modern 20' highway through the isolated heart of Idaho's rugged mountains, was considered by most contractors a job for shovels and dynamite. But, to Triangle Construction Co., of Boise, excavation of 239,878 cu. yds. of disintegrated granite and hard rock in 2.45 miles was still a Carryall and Bulldozer job.

The major problem to start with was side hill slopes as steep as 50°. But, two LeTourneau Bulldozers and "Caterpillar" D8's opened cuts from the top . . . worked the material to the fills, until both cuts and fills were wide enough to permit turning area for D8's and 3 LeTourneau 12-Yard Carryalls.

Then, excavation really began to move. In spite of material that taxed Scraper blades to the limit, more than full loads were obtained. The Carryalls dug, dragged and pushed loads as great as 15 pay yards by taking advantage of steep grades. Average round trips were made in 6 minutes, notwithstanding empty Scraper returns up grades of 50% in the early stages of most cuts. In one month, each Carryall averaged 1,000 cu. yds. per 8-hour shift.

Carryalls and Bulldozers again slap down costs . . . boost profits . . . reassure contractors that jobs figured with LeTourneau equipment is the way to meet today's bids . . . and come out on top! Look to the tough jobs when you consider equipment purchases . . . You'll need that "extra margin" of ruggedness found only in LeTourneau. . . . ask your "Caterpillar" dealer for a demonstration on your job.

ACTUAL JOB DATA

This cut required a culvert 500' long. Carryalls dumped excavated material at the end of the fill; Bulldozer pushed it onto the culvert. Between Carryall trips 'Dozer returned to the cut, trimmed the slope and brought extra pay yards down to the fill.

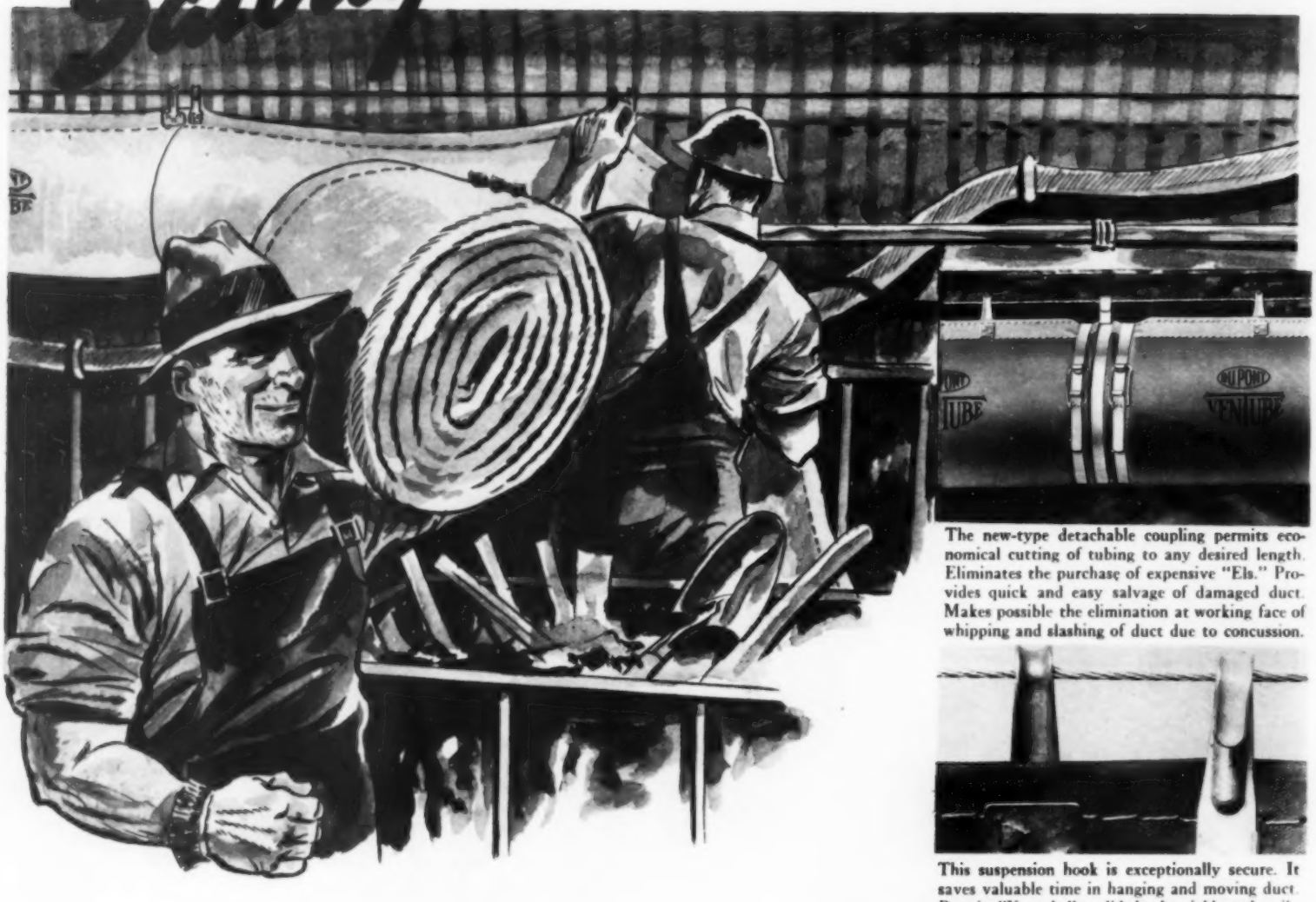
LETOURNEAU

R. G. LeTOURNEAU, INC., • Peoria, Illinois • Stockton, California • Cable Address: "Bobletorno"

Manufacturers of: Angledozers*, Buggies*, Bulldozers, Carryall* Scrapers, Cranes, Drag Scrapers, Power Control Units, Rooters*, Treedozers.

*Name Registered U. S. Patent Office.

Salvaged FOR THE NEXT JOB!



The new-type detachable coupling permits economical cutting of tubing to any desired length. Eliminates the purchase of expensive "Els." Provides quick and easy salvage of damaged duct. Makes possible the elimination at working face of whipping and slashing of duct due to concussion.

This suspension hook is exceptionally secure. It saves valuable time in hanging and moving duct. Permits "Ventube" to slide back quickly and easily from the working face while blasting. And remember: *there's only one genuine "Ventube" ventilating duct. Look for the DU PONT trade mark!*

"VENTUBE" *helps cut tunnel costs!*

YOU don't junk this ventilating system when the job is done. You just take "Ventube" down, roll it up, and carry it to the next job. You salvage "Ventube"—and you save money!

Flexible "Ventube" ventilating duct is made of extra-heavy, long-fibered Hessian cloth. It's *both coated and impregnated* with resistant rubber. It's made tough to stand up under severest tunneling conditions. "Ventube" is highly resistant to acid water, damp or dry rot, fungus, moisture, gases and concussion.

The new detachable coupling makes "Ventube" even more economical.

DU PONT
VENTUBE
THE FLEXIBLE VENTILATING DUCT

Should machinery or heavy firing ever damage the tubing, cut out the mutilated piece and fasten the ends together with the coupling.

"Ventube" hangs fast! Assures adequate fresh air to remote faces! Gets rid of dust *faster!* Speeds up tunnel jobs by making work easier! Install a few sections and see for yourself how "Ventube" actually cuts man-hours and saves money. Distributors are within quick and easy reach.

E. I. DU PONT DE NEMOURS & CO., INC., "FABRIKOID" DIVISION, FAIRFIELD, CONNECTICUT

TIME MARCHES ON

In the days of Button Shoes, LOWELL REVERSIBLE RATCHET WRENCHES were made with many parts and the gears of the sockets had 20 teeth. There always was a Round Hole through the top of the Socket so that the Bolt would pass clear through and the Nut could be run down on the Bolt as far as desired.

Since then we have been working to simplify our WRENCHES and give our customers more Durable and Stronger tools with as few parts as possible.

We recommend and furnish 16 Tooth Sockets and Gears, unless otherwise specified, giving Longer Wearing and more Durable Tools. We did use Pawls that were Curved but today they are all Straight — only 2 in a wrench, of Hardened Steel set into and backed up by the Solid Stock of the Handle and Gear—the STRONGEST CONSTRUCTION POSSIBLE.

The Shipper also works on the solid part of the handle and does not rotate on a pin or screw as in some other tools.

Our Steel Socket Bridge Reversible Ratchet Wrenches are Covered by the following *GUARANTEE:* Any Broken Handle returned to us will be Replaced Without Charge.

Ask your Dealers about LOWELL REVERSIBLE RATCHET WRENCHES. Write to us for Catalogue R and for any further information desired.

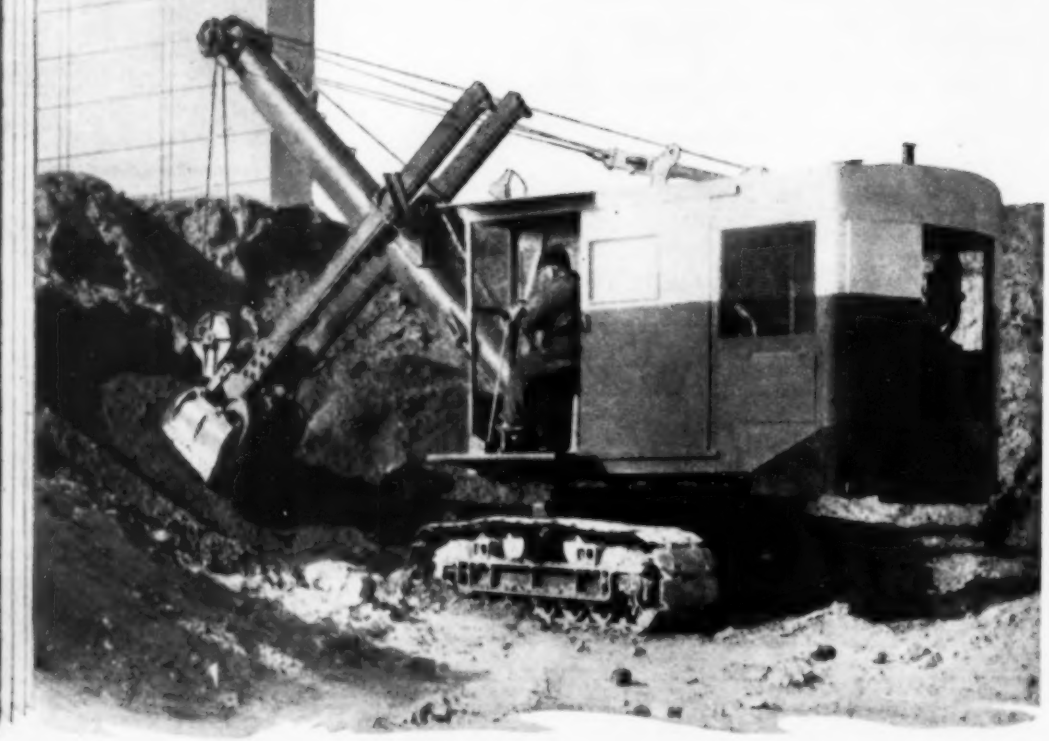
Satisfied Customers are our best Advertisements.

LOWELL
WRENCH COMPANY
WORCESTER MASS.

You CAN BANK ON THE 3/4 CUBIC YARD

MARION

EVERY TIME . . .



"Naturally I was critical in selecting my first power shovel. I wanted speed, dependable performance, simple operation and chief of all . . . low maintenance. I have found everything I wanted in my Marion Type 331-3/4 cu. yd. shovel," says I. J. Lebold, Mineral City, Ohio.

A powerful and compact unit, built to work in close clearances, the type 331 Marion 3/4 cubic yard shovel is a machine on whose speed, power and performance you can bank any time . . . under any operating-condition. Being readily convertible and due to its mobility, it is also admirably fitted for crane or dragline service. See it on the job . . . or write for additional information.

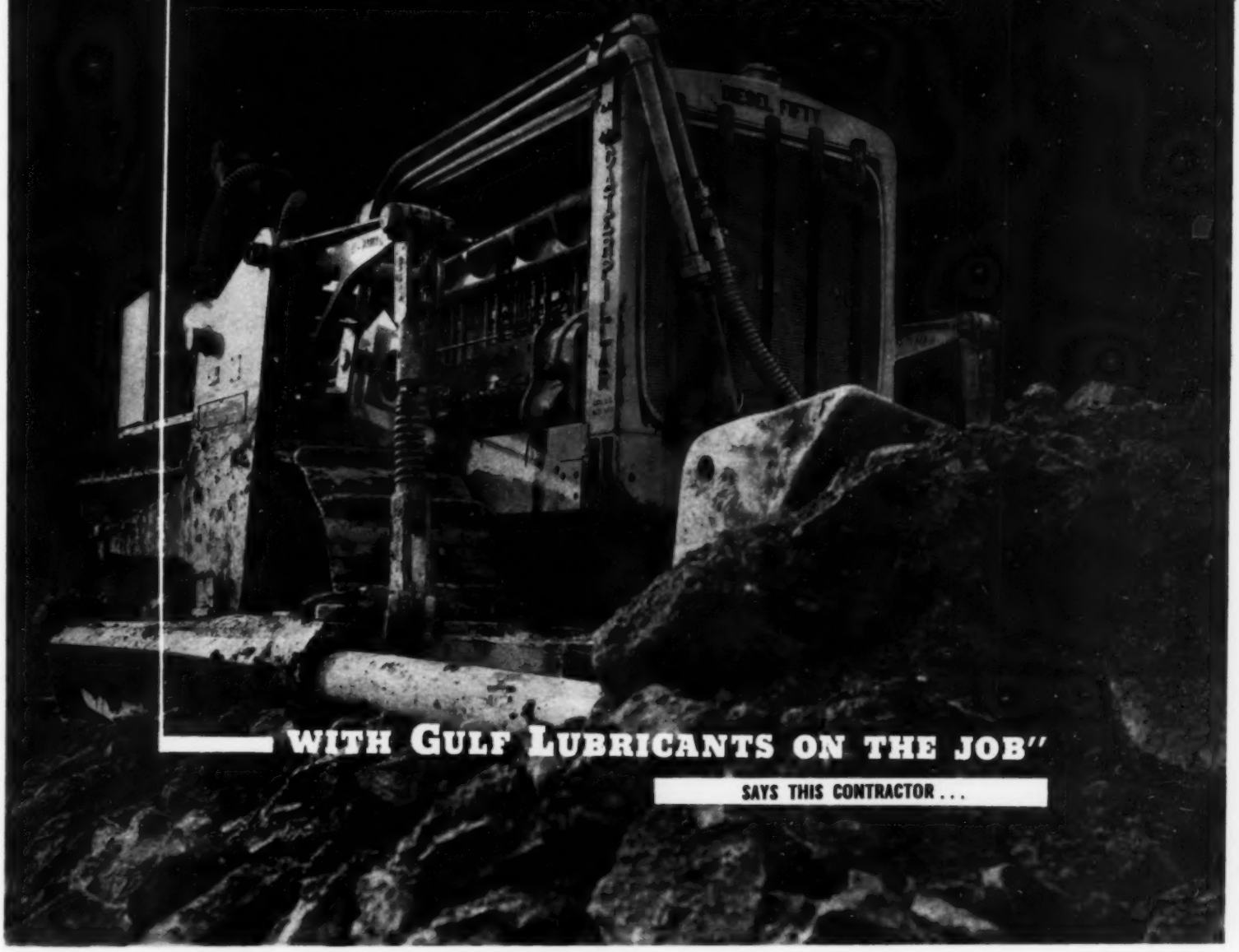
● There is a Marion for every material handling job. » » »

The MARION

STEAM SHOVEL COMPANY, • MARION, OHIO

TOP-NOTCH performance

FROM OUR DIESELS



WITH GULF LUBRICANTS ON THE JOB"

SAYS THIS CONTRACTOR . . .

"THE Gulf engineer's recommendations must have been right!" says this contractor. "We've had top-notch performance from our Diesel equipment on this job."

Gulf engineers are experts on the subject of Diesel engine lubrication. Modern Diesels have been closely studied by Gulf's technical staff, and lubricants have been provided to meet the requirements of *every type* of Diesel in use today.

More than 50 of America's leading Diesel engine builders have approved Gulf lubricants for the engines they build! So, when the Gulf engineer recommends certain brands for your Diesels, you ***know*** they are the *right* brands.

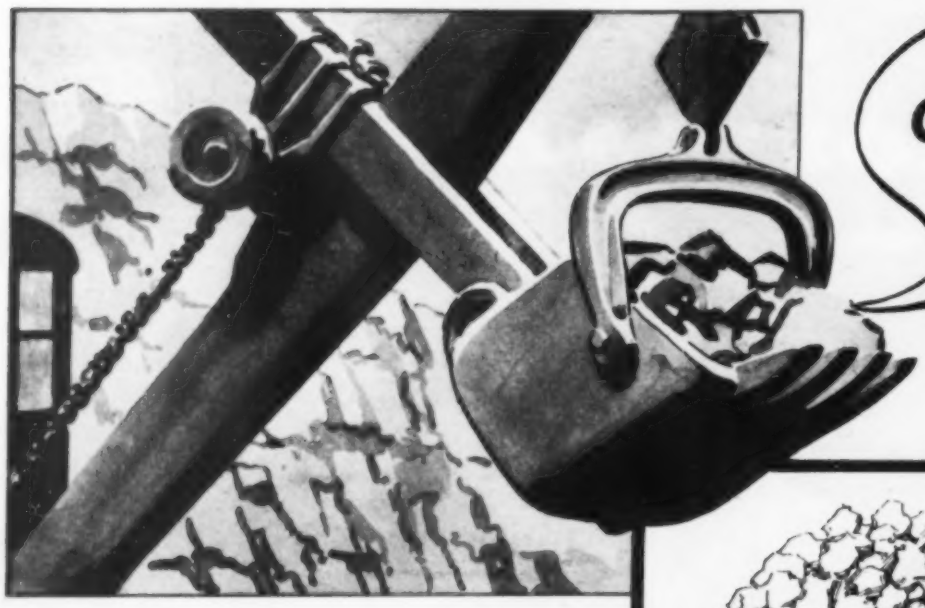
Every operator of Diesel equipment, from Maine to Texas, can have the benefit of Gulf lubrication service — an inexpensive way to insure high-speed, low-cost work.

MAKERS OF GULF NO-NOX ETHYL GASOLINE AND GULFPRIDE OIL

Gulf Oil Corporation GULF INDUSTRIAL LUBRICATION **Gulf Refining Company**

GENERAL OFFICES: GULF BUILDING, PITTSBURGH, PA.

If your shovel could talk



ATLAS Blasting is *Good* Blasting

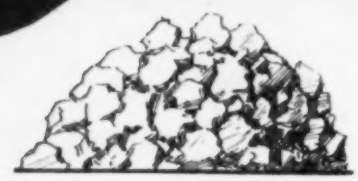
Atlas explosives and Atlas methods will help your shovel *make good*—and help you make a good profit!

A time study on more than 400,000 cubic yards of rock proves that good blasting pays. And—that the man who is penalized by poor blasting *pays—and pays—and pays!*

Then—consider the extra profits and the extra savings *you* might be making. And—determine to make them with Atlas Gelodyns!

ATLAS GELODYNS give gelatin performance at lower cost—only slightly less water resistance than gelatin. Time and again Atlas Gelodyns can be substituted for ammonia gelatins *stick for stick*. And—Atlas Gelodyns cost 18% less per stick.

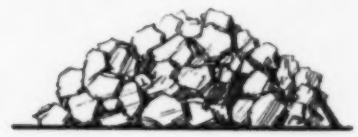
Contractors everywhere will tell *you* Atlas has the right explosive and the right method for any job. Consult the Atlas representative nearest you.



Well Blasted Rock
56.4 cu. yd. per hour

Rock well blasted moved almost as fast by 1 yd. buckets as common excavation! Time studies on 186,532 cu. yd. show:—

Common excavation . . . 59.2
Well blasted rock 56.4
cu. yd. per hour



Poorly Blasted Rock
44.3 cu. yd. per hour

Poorly blasted rock was handled at only 44.3 cu. yd. per hour in 1 yd. buckets—21% slower than well blasted rock—a reduction of more than 100 cu. yd. per day per shovel.

ATLAS POWDER COMPANY, WILMINGTON, DEL.

Cable Address—Atpowco

Everything for Blasting

OFFICES

Allentown, Pa.	Joplin, Mo.	New Orleans, La.	Pittsburgh, Pa.	Spokane, Wash.
Boston, Mass.	Kansas City, Mo.	New York, N. Y.	Portland, Oregon	St. Louis, Mo.
Butte, Mont.	Knoxville, Tenn.	Philadelphia, Pa.	Salt Lake City, Utah	Tamaqua, Pa.
Denver, Colo.	Los Angeles, Calif.	Picher, Okla.	San Francisco, Calif.	Wilkes-Barre, Pa.
Houghton, Mich.	Memphis, Tenn.	Pittsburg, Kansas	Seattle, Wash.	

ATLAS

EXPLOSIVES

CHEMICALS ATLAS EXPLOSIVES

DO YOU KNOW *what these machines Can do for You*

BID THE Buckeye WAY
ask for our operation data before you bid

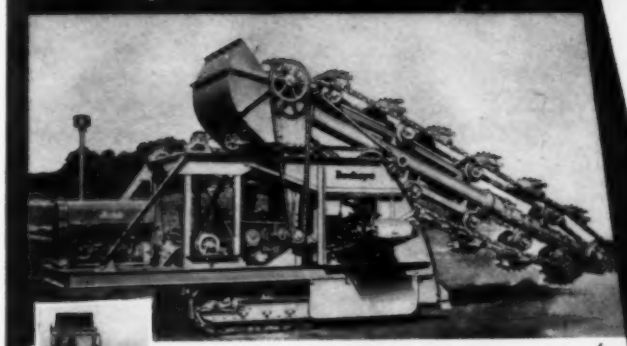
Buckeye✓ *Clipper*
Convertible **EXCAVATOR**
WITH
"MEVAC" CONTROL

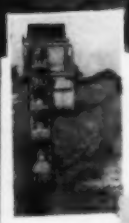
Correct in design; rugged in strength, the Buckeye Clipper piles up big yardage without strain on the operator. For rough work or fine grading.

"MEVAC"—METERED VACUUM CONTROL provides finger-tip pressure that commands instant response and speeds up digging by making every swing of the dipper fast and accurate.

Clipper ½—⅜ and ¾ yard Excavators are easily converted to shovel, trench hoe, crane, clamshell or dragline.

"Give an Operator a Machine he likes and he will give you yardage that pays." Comfortable cushion swivel seat with cushion back rest . . . Every operation independently controlled. Swing, travel and hoist at same time when desired.

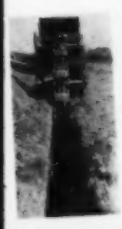




Buckeye Ditcher with boom shifted to left.

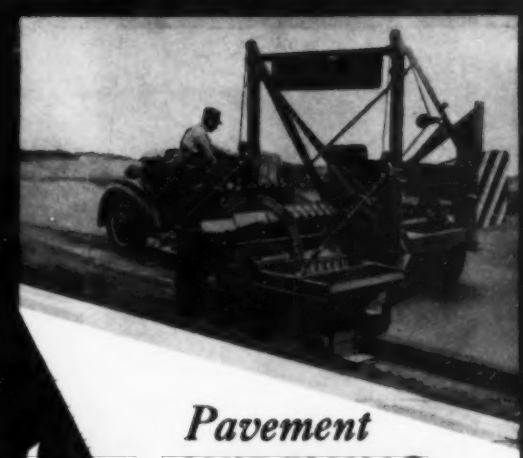
Buckeye✓ DITCHERS *With Shiftable BOOMS*

Digging trench with shiftable boom at right.



Boom shifted for digging down center.

The latest boom type Buckeye ditchers — Models 120 and 160 — have a wide range of usefulness. With shiftable boom, the machine can cut — right, left or center. This allows trench to be cut to within 4" of curb or 10" from poles, buildings or other obstructions. Trench 16" or more wide and to 12' 6" deep, can be dug in hard-to-get-at places or on open country, right-of-way with equal facility. Powerful, rugged, fast — Buckeye Ditchers simplify your difficult ditching jobs.



Pavement WIDENING *Machine*

digs road widening subgrade trench at rate of mile or more per day. Digs trench of uniform width and depth, and leaves subgrades undisturbed, true to grade, clean and ready to receive material. Entire Ditching Attachment removable, permitting truck to be used for other purposes.

Accuracy
WITH THE SURFACE MATERIAL SPREADER

places material where wanted, laying it down in exactly measured volume over every square yard of surface to be covered. Handles sand to 1" stone and spreads volume from mere sprinkle to 100 pounds per square yard. Saves time — saves material — saves expense.

Mail to Buckeye Now

THE BUCKEYE TRACTION DITCHER CO.
FINDLAY, OHIO.

THE BUCKEYE TRACTION DITCHER CO., FINDLAY. OHIO

☐ Surface Material Spreader	☐ Clipper Excavator	☐ Shovel
☐ Pavement Widening Machine	☐ Model 50 ½ yd.	☐ Trench Hoe
☐ 160 & 120 Ditchers	☐ Model 60 ⅜ yd.	☐ Crane
☐ Send a Sales Engineer	☐ Model 70 ¾ yd.	☐ Clamshell
		☐ Dragline

Date.....1938

Your name .....

Company Name .....

City or Post Office ..... *State* .....

The Tiger Swings it!

7/8" AMERICAN TIGER BRAND WIRE ROPE HOISTS WORLD'S HEAVIEST BRIDGE SHEAVE

HERE you see one of the four sheaves, each weighing 56 tons and measuring 15½ feet in diameter, which had to be lifted a vertical distance of 210 feet during the construction of a new lift bridge across the Calumet River in Chicago.

A big job? A tough problem? Yes. But the contractors in charge knew the answer. They used American Tiger Brand Wire Rope—2700 feet of ⅞" cable, 6 by 19, in nine parts. Mounted on a special drum and used with a 100-ton capacity floating derrick, American Tiger Brand came through again. The huge sheaves, largest and heaviest ever made for a bridge, were raised and swung into place "as if between finger and thumb of a giant hand."

How about your tough jobs? Remember the Tiger the next time you need super wire rope performance, or the next time you're hunting for operating economies on ordinary jobs. Over one hundred years' experience in wire-making is behind our claim that American Tiger Brand is the best wire rope you can use.

American Tiger Brand Wire Rope is available in either Standard (non-preformed) or Excellay (preformed) constructions.

U·S·S AMERICAN TIGER BRAND WIRE ROPE

AMERICAN STEEL & WIRE COMPANY
Cleveland, Chicago and New York

COLUMBIA STEEL COMPANY
Russ Building, San Francisco

United States Steel Products Company, New York, *Export Distributors*

USS

UNITED STATES STEEL

NEW ALLOY STEELS
MAKE THE
P&H MODEL 255

The World's fastest 3/4 yard machine!

IT'S FIVE YEARS AHEAD OF THE FIELD

Quickly Convertible to Seven Types of Service

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ALLOY NICKEL STEELS

These large eye bars are part of a Canadian Government order, forged by Canada Foundries & Forgings, Ltd., at Welland, Ont. They will be used in turnbuckle assemblies forming the top hinge of the mitre gate on the Welland Canal locks. The severe service conditions to be met demand a material of exceptional strength and toughness, so Nickel steel was given the assignment. The composition selected shows the following mechanical properties: Yield Point—55,000 p.s.i. min. Tensile strength—80,000 p.s.i. min. Elongation in 2"—28% min. Reduction of area—55% min. Nickel steel billets supplied for the job were produced by Algoma Steel Corp.

Here is a versatile little tool that is practically unbreakable—one that quickly pays for itself—whenever it is assigned to a drilling job. It grips and removes broken drill steel and may also be used as a lifting jack or for removing small shafts, pipe or drift pins. It can be used, too, for tightening cables and forcing pipe underground. Trademarked "Roemer" by its manufacturer, the Longview Pattern Works, Longview, Wash., this sturdy puller and jack is capable of withstanding heavy pulls — in some cases as high as 35 tons. In order to resist the high stresses encountered, the bodies are cast from Nickel alloy steel. Nickel steels are also used in the Timken roller bearings with which the latest models are equipped.

We invite consultation on the use of the Nickel alloy steels and other alloys containing Nickel in your equipment.

Public utilities can't always wait for favorable weather to set their poles for power lines and telephones. They can't always pick the kind of soil that yields quickest to the spade. Hence, the Highway Trailer Company of Edgerton, Wis., produced this combination earth borer and pole setter, which goes through frozen soil and heavy clay with equal facility. Naturally, the gears and shafting used in this machine are subjected to unusually severe punishment. So the manufacturer specifies Nickel alloy steels *"to withstand shock and wear, and assure long life."*

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A National Organization to Improve and Extend the Uses of Concrete

• Spreckels Sugar Company Plant No. 3, near Woodland, California. Includes administration building and laboratory, warehouse in rear, and 5 bulk storage bins — all of reinforced concrete with concrete floors and exterior walls. Architect, Harry A. Thomsen, Jr., successor to George W. Kelham; contractor, Dinwiddie Construction Co. — both of San Francisco.

Architectural Concrete — WALLS AND ORNAMENT CAST INTEGRAL WITH FRAME AND FLOORS

2 + 2 = 4 for Wm. P. McDonald

AFTER a thorough study of the time-cycle, work range, and operating economy of two Bucyrus-Erie 4-Wheel Scrapers, William P. McDonald, prominent eastern contractor, selected these two units, plus two more, for his highway job near Riverhead, Long Island. These Scrapers have a rated capacity of 4½-yards, *struck measure*, and are of a type and size that presents a radical departure and development in earth-moving methods.

In addition to the fleet of four Scrapers, Mr. McDonald bought a Bucyrus-Erie Bullgrader, a Bulldozer and a 19-B dragline for this same highway job.

It will pay you to investigate Bucyrus-Erie's modern line of Scrapers for your job!

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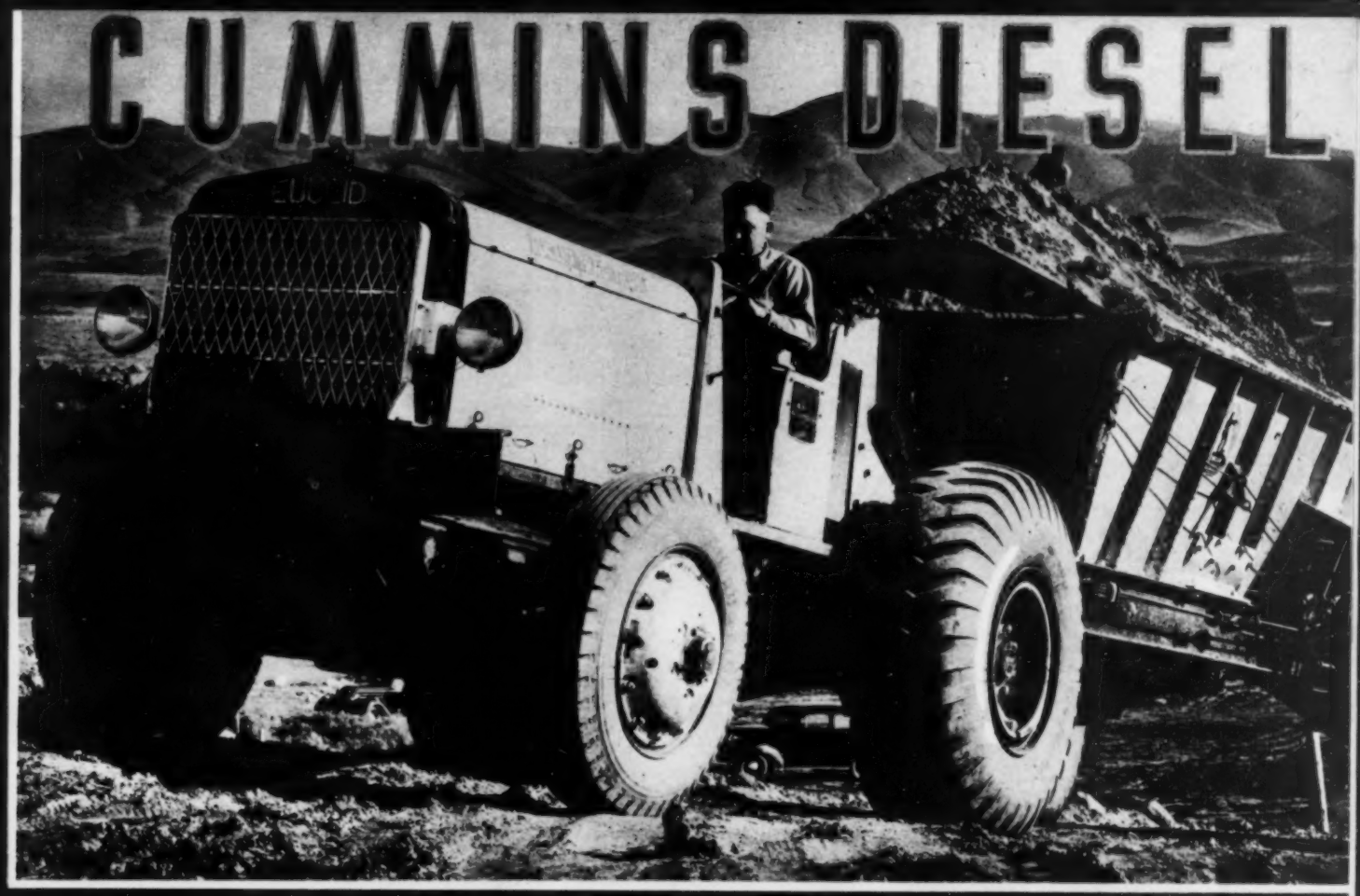

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"Twice as Far for Half as Much" means more than simple fuel economy. It means an all-over economy in fuel, lubricating oil and low maintenance. Cummins Engine Co. 1704 Wilson St., Columbus, Ind.

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with Economy and Speed

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Hutchinson, Kansas

Architects
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Voscamp and Neville,
Kansas City, Mo.
and
A. R. Mann & Co.,
Hutchinson, Kansas

General Contractors
M. C. Foy & Son,
Hutchinson, Kansas

In winter, concrete curing slows up. To offset the long idle time waiting for concrete to harden, and to speed up the construction schedule, the contractors, M. C. Foy & Son, used Lehigh Early Strength Cement to make quick service concrete.

For the owner, with the building 80% rented in advance, it meant quicker completion.

For the contractor, quick curing saved time and money.

Heat-protection costs were two-thirds less.

Stripped 5 days sooner and re-used, form sets were reduced from 4 to 2 for column heads, and from 3 to 2 for floors—a saving of $500. Total estimated saving was $1500.

Contractors find it profitable to use Lehigh Early Strength Cement in any season. In 24 to 48 hours, under the same conditions, its strength compares with that of normal portland cement at 7 days. In cold weather its added advantages are—lower heat protection cost and less possibility of concrete freezing.

Consult the Lehigh Service Department on the use of Lehigh Early Strength Cement for any purpose. Send for cold weather data.

LEHIGH PORTLAND CEMENT COMPANY, Allentown, Pa., Chicago, Ill., Spokane, Wash.

LEHIGH EARLY STRENGTH CEMENT

Construction Methods and Equipment

Established 1919 McGraw-Hill Publishing Company, Inc.

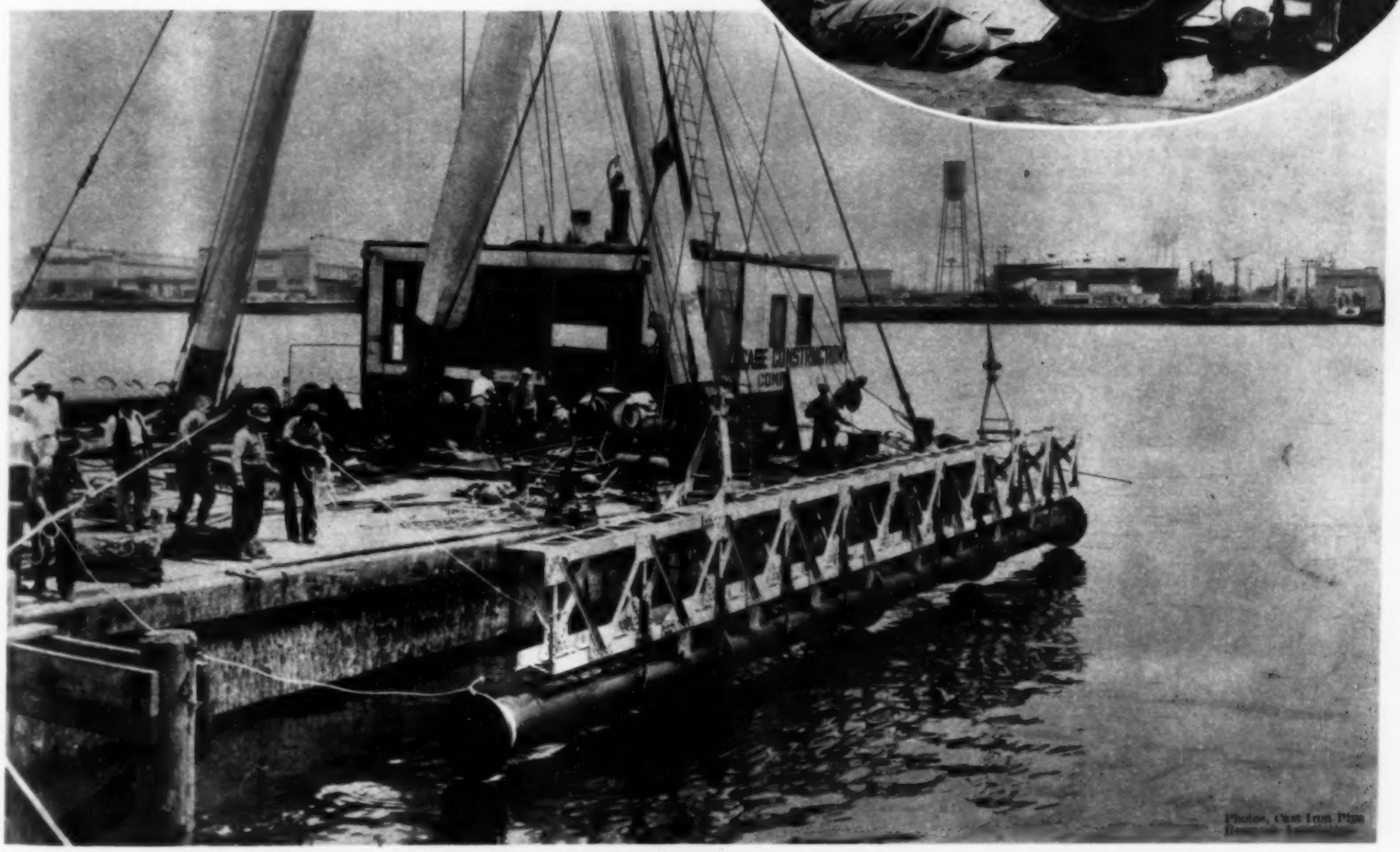
ROBERT K. TOMLIN, Editor

Volume 20 **February, 1938** Number 2

Submarine Pipe

With Flexible Joints

Laid by Strong-back



STRONG-BACK of structural steel handles four 16-ft. lengths of 20-in. pipe jointed into units 64 ft. long for lowering into trench dredged in channel bottom. BALL END **(in inset)** of mechanical joint, providing flexibility in pipe line, is inspected by Al Monro, **(left)** superintendent, Los Angeles Harbor District and E. W. Pearcy, inspector.

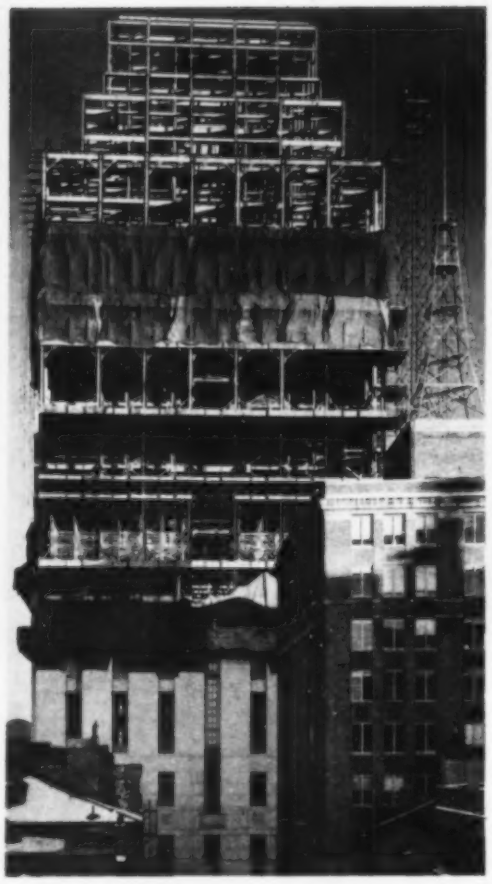
CAST-IRON PIPE in 16-ft. lengths, 20 in. in diameter, connected by mechanical ball joints, was laid to form a submarine water main across the 1,400-ft. ship channel between Los Angeles, Calif., and its suburb, Terminal Island. On the west side of the channel the new main extends out on concrete piling to the pier head line where it joins a vertical riser extending down to the channel bottom, thence crossing in a dredged trench to the Terminal Island side.

The vertical riser on the west end of the line, consisting of four 12-ft. lengths of flanged cast-iron pipe, jointed and incased in concrete, was constructed within a caisson of interlocking steel sheetpiling driven to a depth of 51 ft. below mean low water. At the bottom of the riser a 90-deg. elbow provides a connection with the line across the channel.

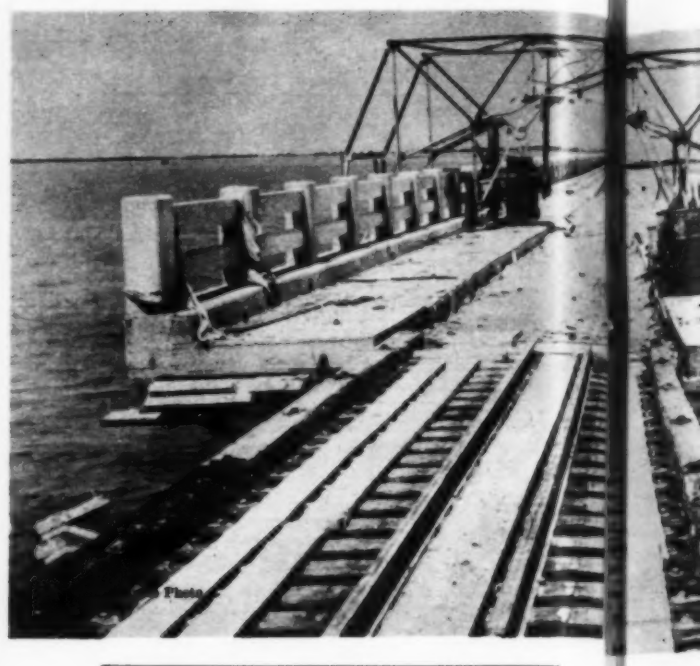
The cross-channel main was laid in a trench dredged to a depth of 10 ft., so that the top of the pipe was 45 ft. below mean low water. The pipe was assembled on a barge into 64-ft. sections consisting of four lengths, jointed and handled as a unit by a structural steel strong-back operated from a derrick barge. Divers made the connections between the 64-ft. pipe sections.

The work was done by The Case Construction Co., of Alhambra, Calif., under the direction of the Los Angeles Bureau of Water Works and Supply, of which H. A. Van Norman is chief engineer; W. W. Hurlbut, engineer of waterworks; and Samuel A. Evans, civil engineer, who prepared plans and specifications.

DEEPEST DAM IN WORLD (above). is Parker dam on Colorado River in California. Foundations extend to depth of 235 ft. involving 280,000 cu.yd. of concrete. Will divert river water into Colorado River Aqueduct. Structure is being built by J. F. Shea Co., Inc. — Photo, U. S. Bureau of Reclamation.

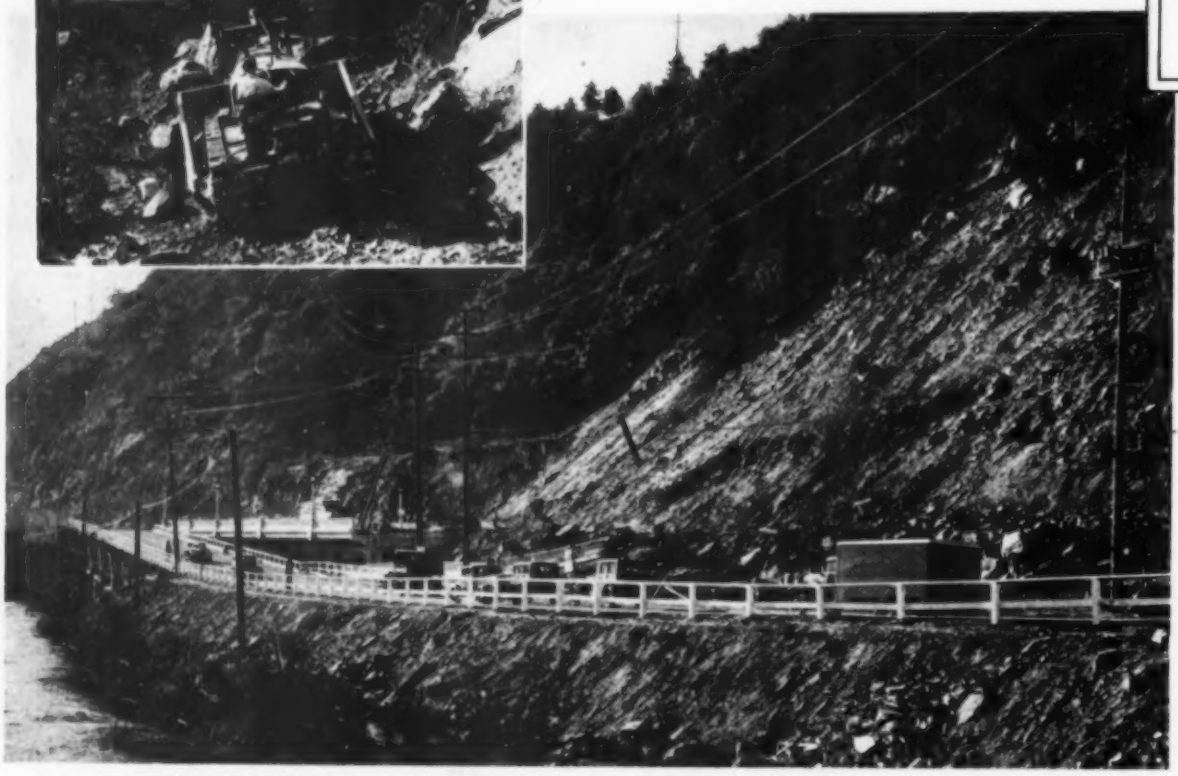


NEW COURT HOUSE for Suffolk County, Boston, Mass., will top Beacon Hill skyline and provide $5,000,000 in new building quarters for overcrowded judicial and clerical activities. About 400 men are employed and the job is due for completion June 15, 1938. Fourteen stories and 11 mezzanine floors are required as a result of court room heights provided by the architects, Desmond & Lord, Boston. General contractor is George A. Fuller Co., of the same city. The structure has reinforced concrete foundations, steel frame, granite and brick walls and reinforced concrete flooring. About $5,000 worth of canvas is being used to facilitate work in winter weather with salamander heating of interior of structure.



This Month's

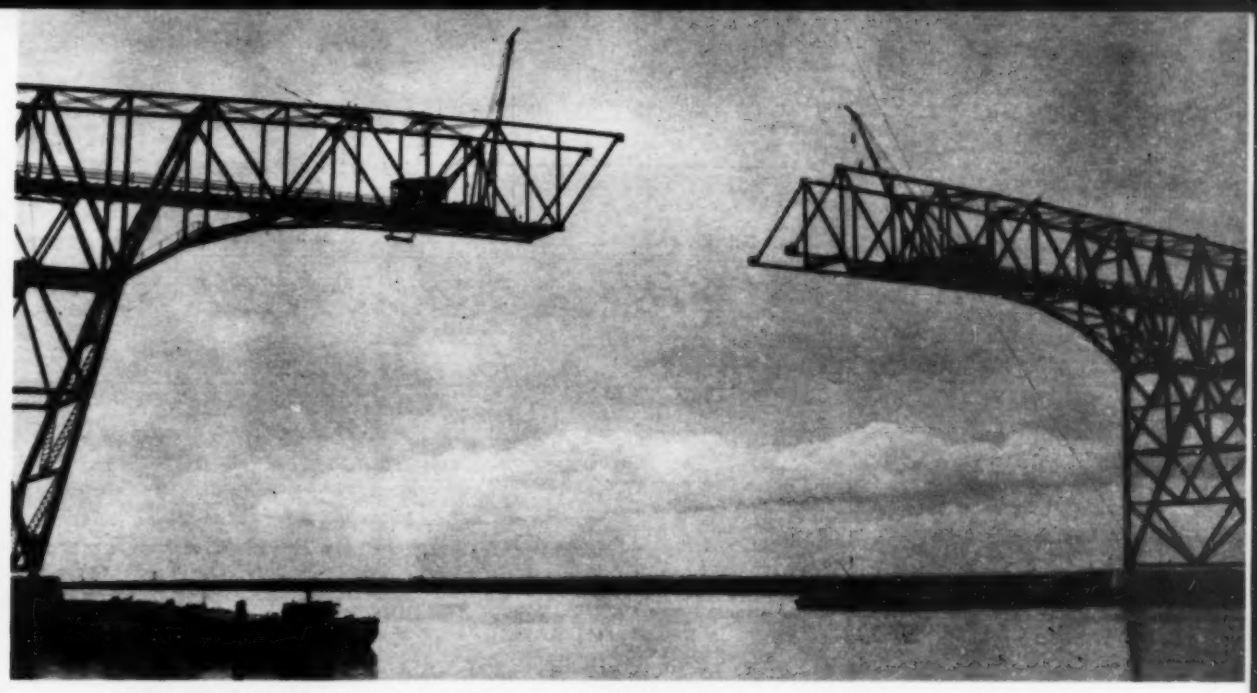
"NEWS REEL"



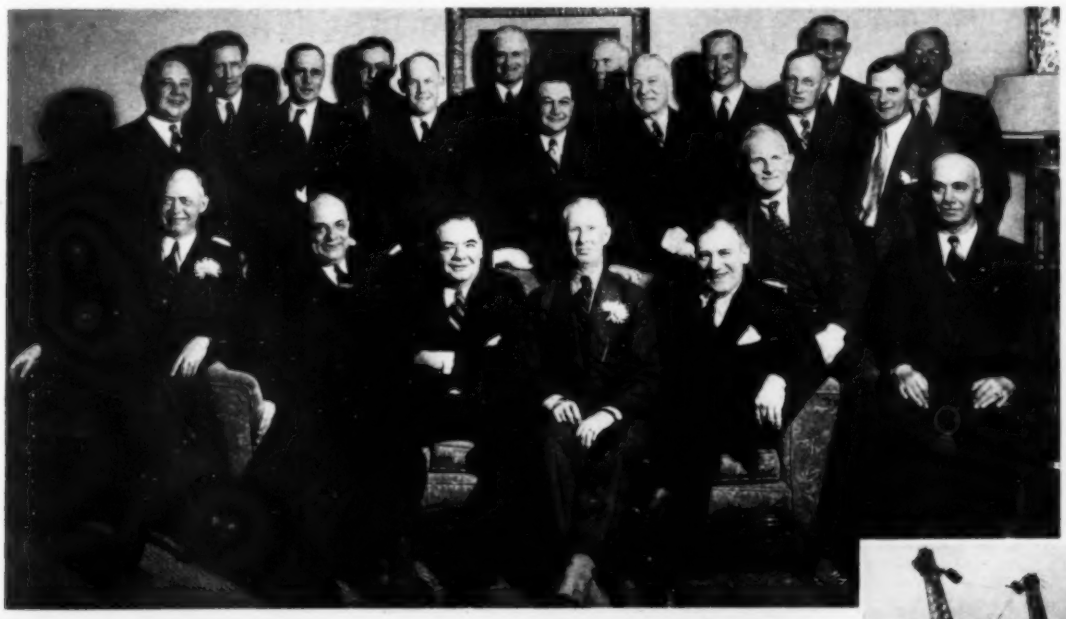
TEMPORARY ROADWAY is rushed to completion around mountain slide that destroyed Riverside viaduct in Los Angeles, Calif. Allis-Chalmers tractor **(insert)** equipped with bulldozer removes large rocks brought down by slide estimated to contain 1,500,000 cu.yd. of material. Temporary roadway was completed in 12 working days.

CHICKAMAUGA DAM, TVA project on Tennessee River, has reached stage of partial completion. At left is completed navigation lock and part of north shore earth dam. Cellular cofferdam incloses operations for second stage of construction. Concrete piers are completed for first 14 bays of gate spillway section. Operating deck of spillway is under construction at left.

OVERSEAS HIGHWAY between Miami and Key West, Fla., involves widening and reconstruction along Florida Keys of old road bed and bridges of Florida East Coast Ry. Reconstructed route will be 33 mi. long. Old railroad line was abandoned after it had been damaged by hurricane in 1935.

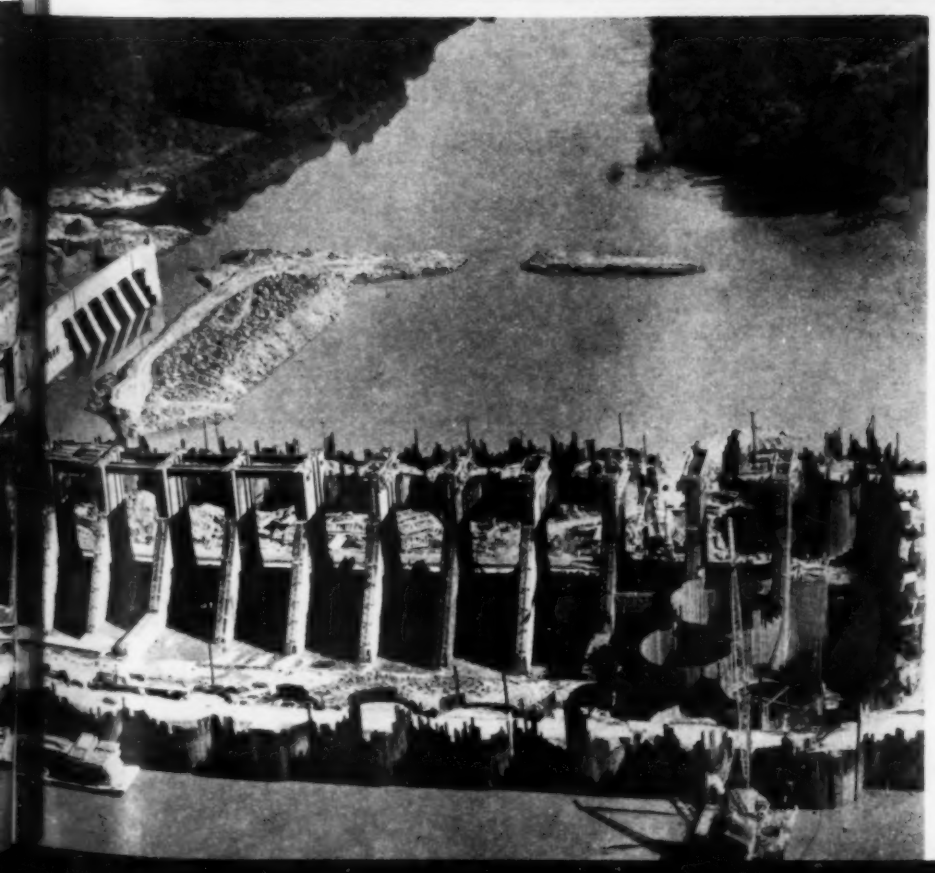


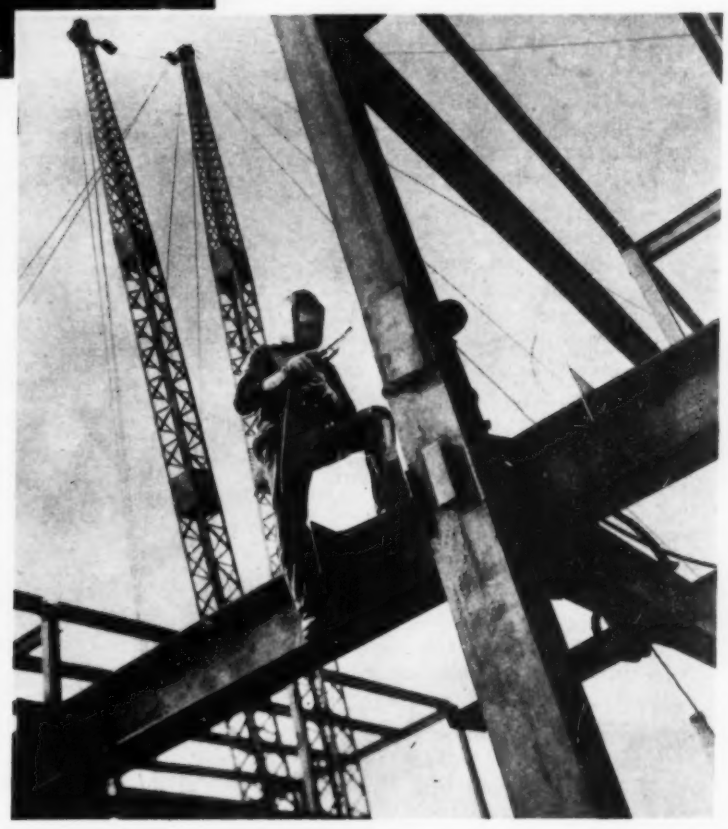
WITH ONLY 136 FT. left to go, cantilever arms of 680-ft. main span of Neches River bridge, Port Arthur, Tex., approach closure high above level of Gulf coast marshlands, providing 176-ft. clearance for shipping. Man on upper chord, near boom of traveling derrick at right, stands 225 ft. above water. Bridge will be ready to carry highway traffic in March. Taylor-Fichter Steel Construction Co., New York City, erects superstructure on caisson piers sunk by Union Bridge & Construction Co., Kansas City, Mo. Texas Highway Department supervises construction of $2,750,000 project financed by state, by local bond issues and by PWA grant. Ash, Howard, Needles & Tammen, Kansas City and New York, are designing and consulting engineers.



LOW BIDDER (left), for topping out Grand Coulee dam to ultimate height of 533 ft. was Interior Construction Co., with tender of $34,442,240 submitted Dec. 10 to U. S. Bureau of Reclamation. Shown in picture are members of seven component companies forming new organization and including: Mason - Walsh - Atkinson - Kier Co., Morrison Knudsen, J. F. Shea Co., McDonald & Kahn, Pacific Bridge Co., Henry J. Kaiser, Utah Construction Co., General Construction Co.

ARC WELDING (below), with alternating current was used for first time in fusing all of the steel framework for new office structure at Westinghouse Electric & Manufacturing Company's transformer works in Sharon, Pa. A helmeted welder is shown at work on one of the columns.





"We Saved $1.22 Per Cubic Yard on Winter Concreting"

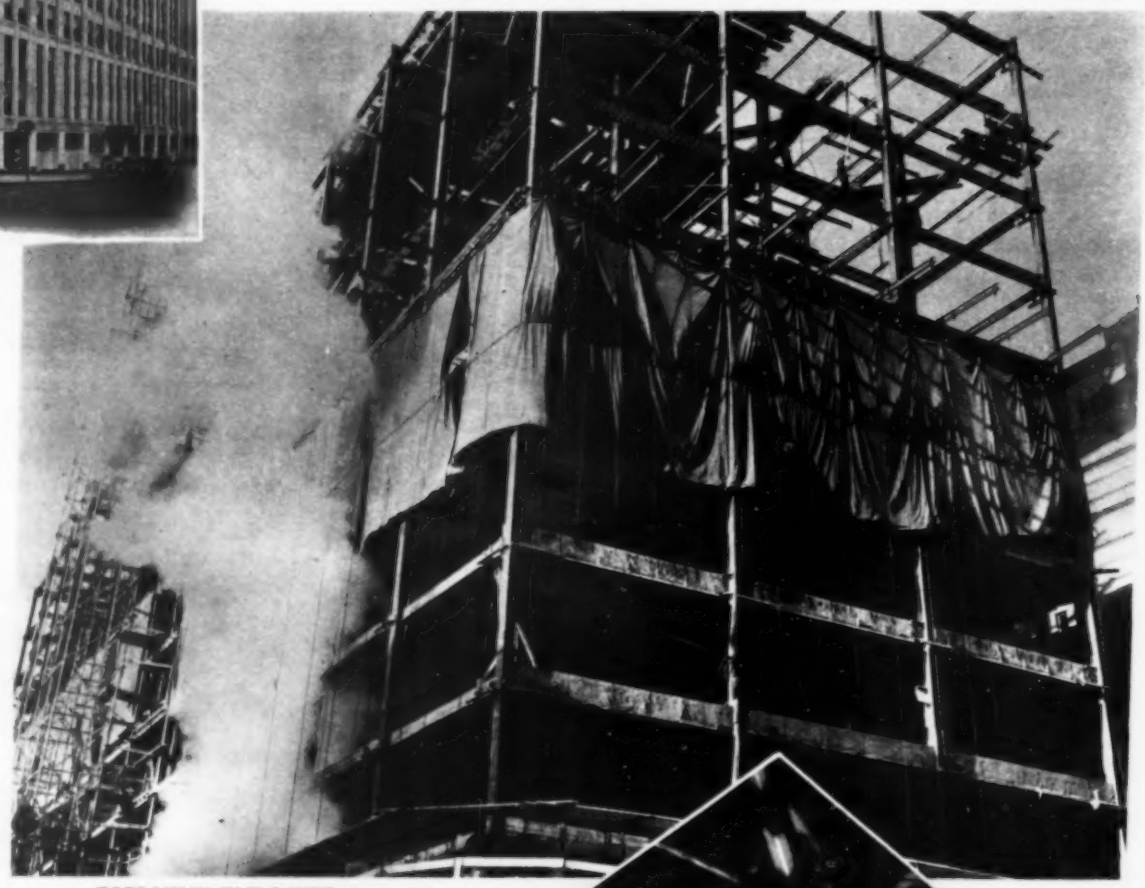
By FRANK P. SCULLY and GEORGE T. ROONEY
President *Construction Engineer*
The Scully Co., Boston, Mass.

PRODUCT OF WINTER CONSTRUCTION. Eleven-story building, with steel frame and concrete floor slabs, completed for New England Power Co. in Boston.

SLOW HARDENING of concrete at low temperatures has been largely responsible for blocking a much discussed development in building construction — a 12-month building year. Adequate strength development in winter meant expensive heat protection over extended periods; that increased costs; hence, contractors had to ask higher prices for cold-weather work, with the result that only those projects that could not "wait 'til spring" went forward in the winter season.

It stands to reason that as this cold-weather cost differential is reduced, the volume of winter work can be definitely increased, with profit to the contractor, by adding from 3 to 5 months to his income account, and with corresponding advantage to the owner, through sound price economies due to off-season work and earlier occupancy and use. Already the pendulum has begun to swing in that direction, as engineers and contractors in steadily increasing numbers have tackled the job of minimizing winter concreting costs. This job is, first of all, one of simple analysis: To find the concrete mix and heat-curing period which will produce the lowest total of four principal cost items — cement, heat protection, forms and fixed job overhead.

Obviously, no fixed rule applies. A leaner mix, for example, may show a lower cement cost but develop strength slower and require longer heat protection than a richer mix. Again, if fixed job overhead is low,



TARPAULIN INCLOSURE, heated by salamanders, protected newly concreted floor slabs from cold for 2 days.

FORMS (right) for concreting floor slabs were hung from beams of steel frame of building.

FORM ASSEMBLY (left), placing of reinforcing steel and conduits required 6 days and concreting, 1 day, using three floors of forms.

● Here is a practical example of how construction economics were put to work to lower the cost of building an 11-story steel and concrete structure during cold weather for the New England Power Co., in Boston, Mass.

— EDITOR

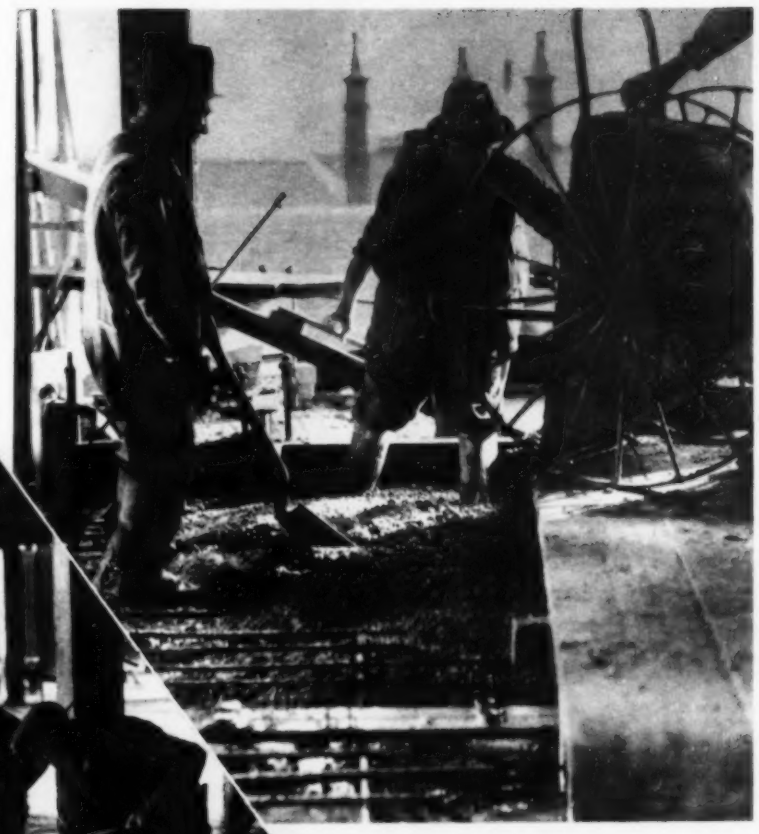
it may pay to use a lean mix, supply heat protection and wait for the concrete to gain service strength. On the other hand, as fixed job overhead or time costs increase, it usually pays to use either a richer mix or high-early-strength cement and heat protection sufficient to develop service strength within a short time.

These are the variables entering into the selection of the most economical method of building any given concrete job in winter. There is nothing complicated about it, and usually the stakes are big enough to make the effort really worth while. Consider, for example, the following reasonably typical situation which resulted in a net saving of $1.22 per cubic yard of concrete on a recent cold-weather project.

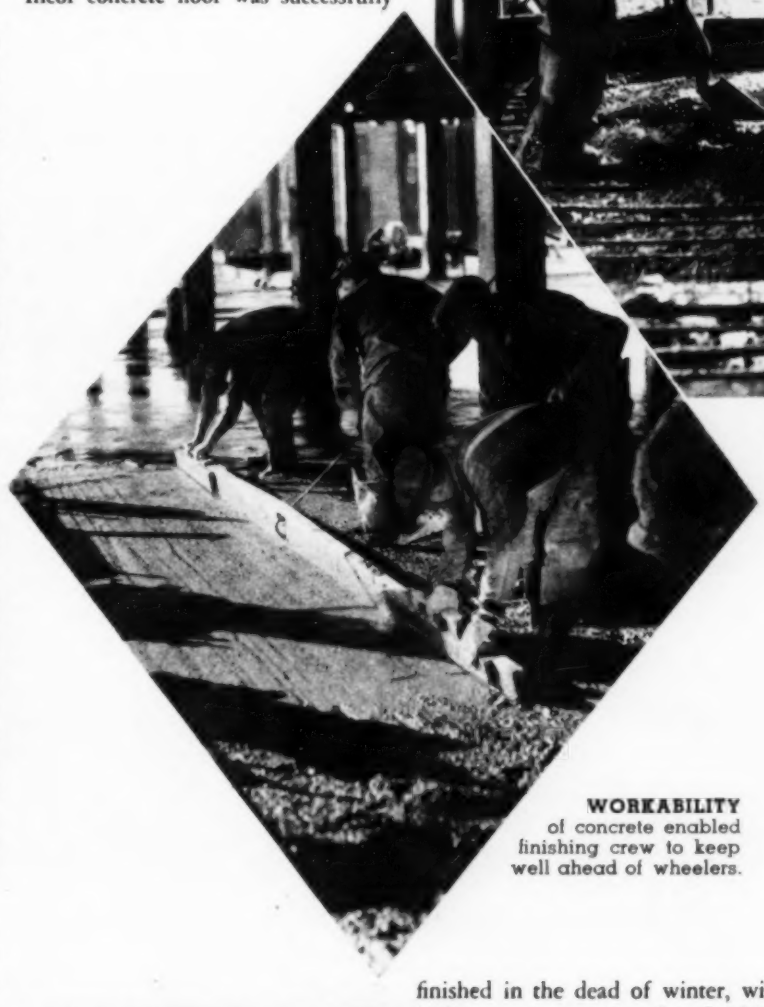
The job in question is the New England Power Co. building in Boston, Mass., concreted in mid-winter, 1936-37, by the Scully Co., concrete contractors for T. A. Pearson Associates, general contractors. This was an 11-story and roof job, rectangular plan, with concrete slabs supported on steel framing. First step was to ascertain the concrete mix which showed the lowest *overall* concreting cost. A design concrete using 5 bags of Incor 24-hour cement, producing 3,300 lb. per square inch in 7 days, using 7 gal. of water or less per bag, showed the greatest economy, in direct comparison with rich-mix ordinary cement.

Concreting started Dec. 15, was finished before Feb. 1—better than 1½ floors a week. Concrete was placed 3 days a week, one-half floor at a time. Three floors of forms were used. Form assembly, placing of reinforcing steel and conduits required 6-days, concreting 1 day.

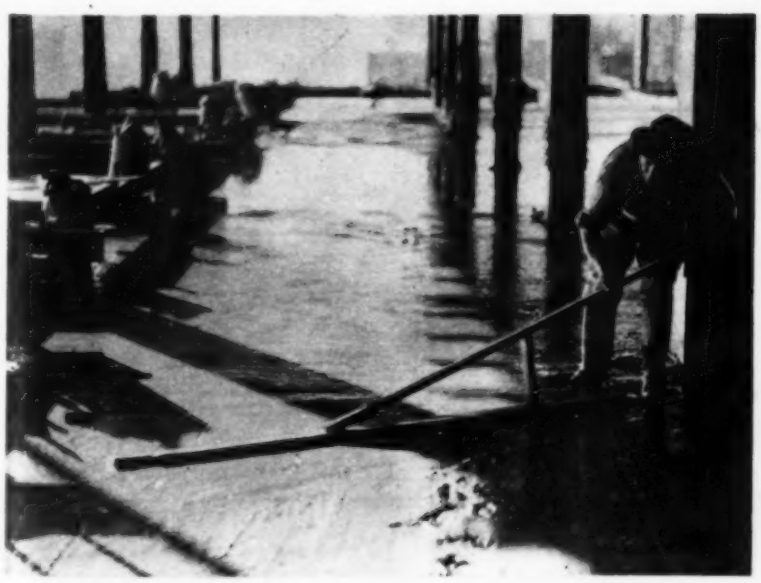
This 5-bag mix, using 7 gal. of water, produced a concrete with a 5-in. slump. Workability is indicated by the fact that about 170 cu.yd. were placed in 6 hr., men working the concrete being able to keep well ahead of the wheelers. Finishers started final troweling about 3 hr. behind the concreting gang. This Incor concrete floor was successfully finished in the dead of winter, with little or no overtime for finishing labor.



CONCRETE. made of high-early-strength cement, was placed by wheeled carts 3 days a week, one-half floor at a time.



WORKABILITY of concrete enabled finishing crew to keep well ahead of wheelers.



FINISHING of floor slabs was done in dead of winter, with final troweling following about 3 hr. behind concrete placing gang.

Cost Factors

Concrete in place was protected from cold for 2 days by supplying heat from salamanders within the tarpaulin—inclosed floor—a saving of 1 day per floor as compared with the next cheapest schedule. Fuel consumption averaged 3.2 tons per day, which, at $10.50 a ton, totaled $33.60 a day. Labor tending fires cost $37.20 a day, making total daily fuel and labor costs $70.80. That amount, saved on each of 24 pours, lowered heat protection costs by $1,623, not counting the extra floors of tarpaulins which normally would have been required.

Three sets of forms were used on this job. The next best construction schedule would have entailed four sets, at an additional cost of $2,500.

The third cost factor, fixed job overhead, showed this picture: Daily time costs came to $162; the schedule used on this job showed a time saving of 15 days, as compared with the next best schedule; this meant a further saving of $2,430.

The total of these savings on heating expense, forms and time thus amounted to $6,553. Which brings us to the fourth factor in the cost equation — cement. In this instance, Incor increased the cement bill by $1,900. Deducting the extra cost of the high-early-strength cement from the $6,553 gross saving left a net saving of $4,653. And that figures out at $1.22 per cu.yd. of concrete.

This job illustrates what may be termed the practical economics of winter concreting. Details, of course, vary with type of work and degree of exposure encountered. But regardless of variations in details, the same principles apply to all cold-weather work. The key to lower building costs in winter — indeed, one might almost say, the possibility of winter concreting on summer schedules at costs fairly approximating summer rates — is simply this:

Select a mix with workability adapted to job conditions, and one that will gain strength fast enough so that the total cost of cement, placing labor, heat protection and forms is a minimum. No theory, this; instead, it points a practical way toward new profits for the construction industries through reduced off-season costs and year-around building.

Suspended Scaffold

Aids Erection of

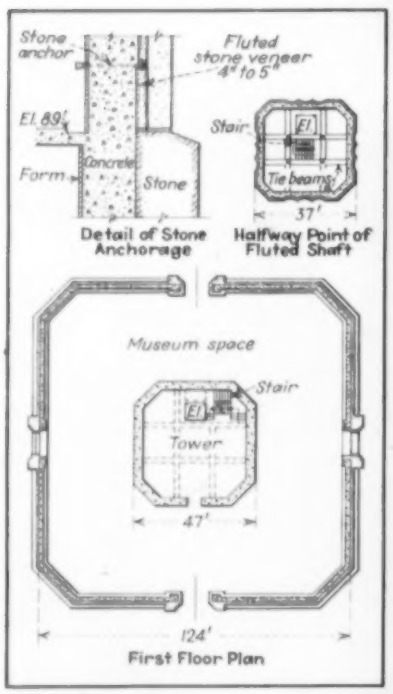
San Jacinto Memorial,

564-Ft. Concrete Tower With Limestone Facing

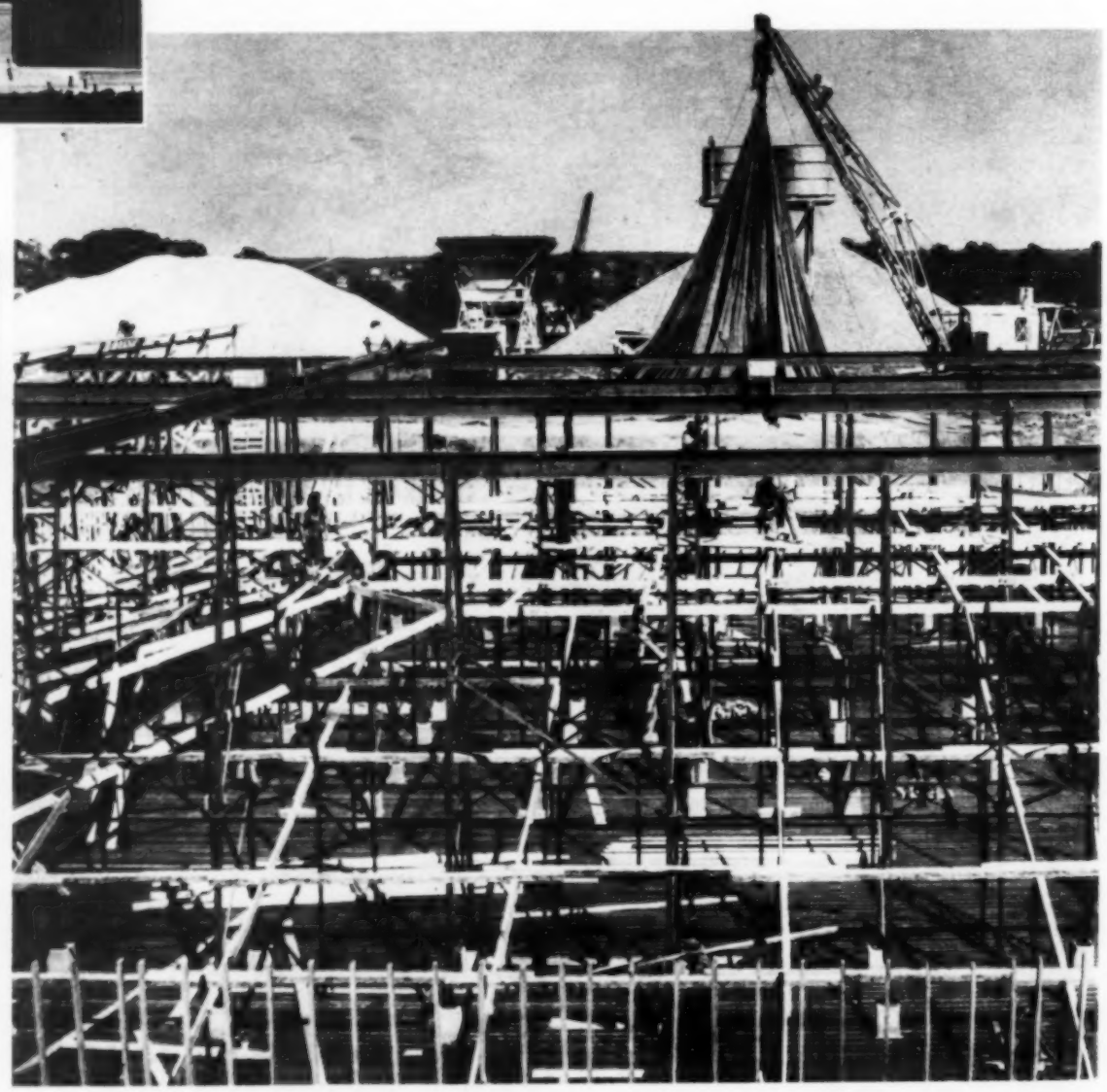
By ROBERT J. CUMMINS
Consulting Engineer, Houston, Texas

COMMEMORATING the victory by which General Sam Houston defeated Mexican forces under General Santa Anna in 1836 and established Texas as an independent state, a concrete tower faced with limestone, 564 ft. high, similar in general appearance to the 555-ft. Washington monument in the nation's capital, has been erected on the historic San Jacinto battleground, about 20 mi. southeast of Houston, Tex. The tall, tapering shaft, octagonal in section, 47 ft. wide at its base and 30 ft. at its top, is carried on a heavily reinforced concrete footing 124x124 ft. in plan, and 15 ft. thick, which serves also as the base for the outer walls of a museum gallery, 31 ft. high, built around the tower to house historical relics and provide rooms for meetings. The monument was built with funds totaling $915,000, of which the State Legislature of Texas appropriated $250,000, the Federal Gov-

STAR-TIPPED SHAFT of concrete faced with fluted limestone, extends to height of 564 ft. above footing.



DETAILS of memorial tower showing museum space around base of shaft and method of anchoring fluted limestone veneer to concrete walls.



FOUNDATION. with steel reinforcement in place, ready for pouring of concrete. Steel frame is erected for support of extended booms of paving mixers.

ernment $400,000, supplemented by a $225,000 PWA grant, local interests in Houston $40,000.

Foundation designs provided for 8,000 lb. per square foot as the safe limit of soil pressure on the bed of stiff red clay which borings disclosed at the site. On this basis a footing 110 ft. square would have been required to support the tower. The museum structure at the base of the shaft, however, was 124 ft. square, so that it was decided to increase the size of the footing to carry the museum walls, in addition to the tower, rather than to construct an outer ring or a series of separate footings for that purpose. The total dead load of the structure amounts to 70,300,000 lb. and as the base has an area of 15,040 sq.ft. the resulting soil pressure is 4,700 lb. per square foot.

Above the roof of the museum the shaft is faced with a veneer of Texas limestone varying in thickness from 6 to 16 in. and backed solid with brick. At a height of 89 ft. above the first floor the flat stone facing merges into a fluted veneer, 4 in. and 5 in. in thickness, of buff-colored limestone. The monumental shaft is topped by a five-pointed 45-ft. star, Texas state emblem, equipped with a beacon light for the guidance of aircraft.

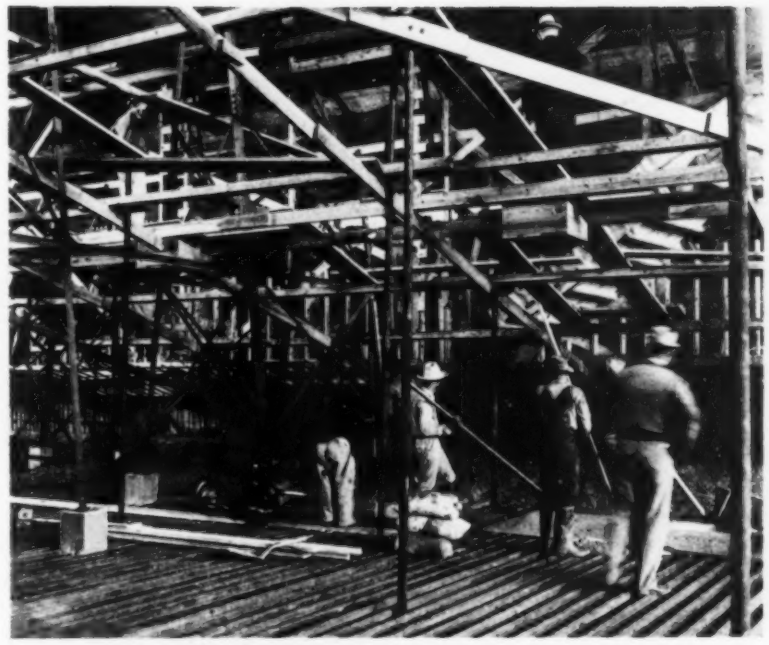
In order to meet architectural demands the walls of the shaft, at its base, were made 48 in. thick, somewhat in excess of theoretical requirements. Where the fluted section begins at El. 89 the shaft wall thickness is 24 in., decreasing from that point to a 12-in. thickness at the top. Throughout the height of the shaft at 24-ft. intervals two concrete beams are introduced in each direction for the support of the concrete stairs and the anchorage of the elevator guides. These beams were poured monolithic with the walls of the shaft and were utilized by the contractor for the support of a walking platform.

Preliminary to pouring the reinforced footing for the tall shaft the contractor covered the excavated foundation with a 3-in. layer of concrete which served the dual purpose of excluding water from the soil on which the footing was to rest and also provided a satisfactory working floor on which to assemble the steel reinforcement.

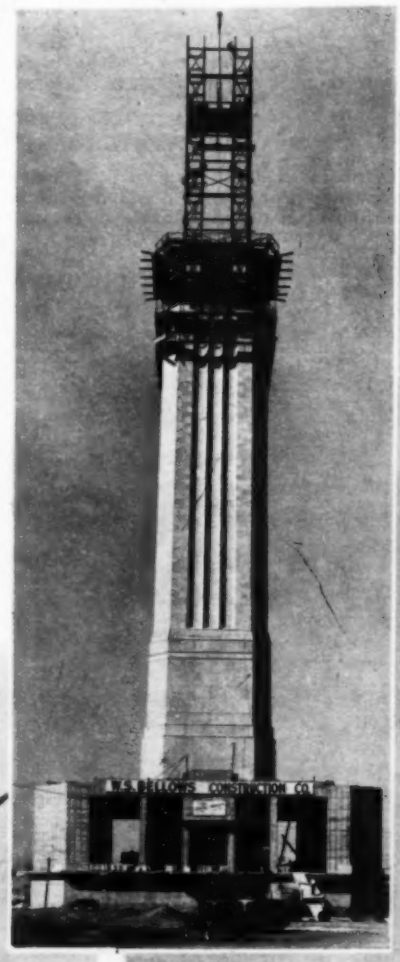
Construction Features

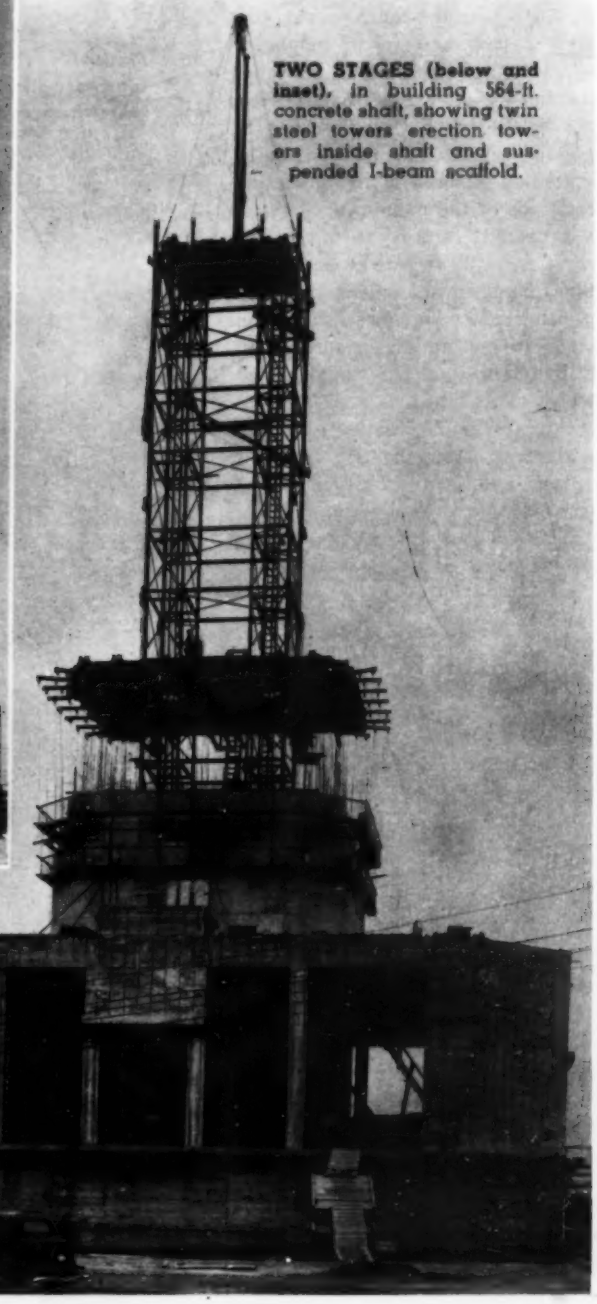
From a construction standpoint one of the interesting problems was the pouring of the 124x124-ft. concrete footing under the tall structure. This mass had to be poured as a monolith, and as it contained 5,600 cu.yd. of concrete, the contractor not only assembled all materials on the ground in preparation for the pour, but in addition to two paving mixers of 30-cu.ft. capacity which he used in making the pour, he installed an auxiliary third mixer which he used part of the time, and held in reserve a fourth mixer to be put to use in case of a breakdown.

The two paving mixers were mounted one on each side of the

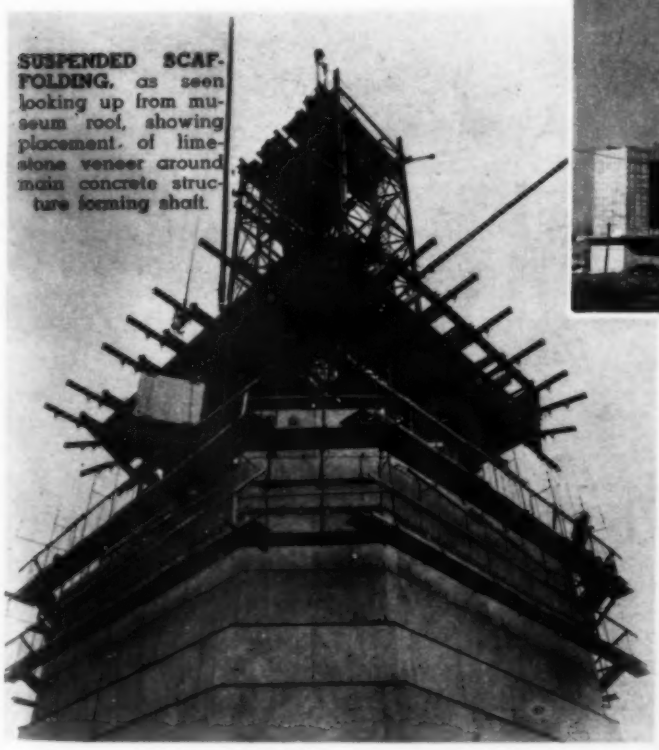


CONTINUOUS POUR, extending over 60 hr., placed 5,600 cu.yd. of concrete in tower footing.





TWO STAGES (below and inset), in building 564-ft. concrete shaft, showing twin steel towers erection towers inside shaft and suspended I-beam scaffold.



SUSPENDED SCAFFOLDING, as seen looking up from museum roof, showing placement of limestone veneer around main concrete structure forming shaft.

hole, and the concrete batches were transported to the center of the footing by extended booms supported on a steel framework built up from the 3-in. concrete slab which was poured over the entire area of the base. This slab also formed a substantial support for the 2-in. square steel bars, 110 ft. long and 426 in number which were used to reinforce the foundation. These bars were spaced 6½ in. on centers in each direction. As an added precaution the contractor erected a circus tent over the hole to prevent rain interfering with the pouring. The entire pour was completed in a little more than 60 hr. or at the rate of approximately 90 cu.yd. per hour.

The concrete shaft itself is 47 ft. wide at the base, 44 ft. wide at El. 89 and 30 ft. wide at the top, where is located the observation gallery, commanding a view of the surrounding country and far out into the Gulf of Mexico. The shaft throughout is faced with Texas limestone quarried near Austin. That portion extending above the roof of the museum and to El. 89, where the fluting starts, contains a panel 16 ft. in height on which will be depicted, in bas relief, the history of Texas from the date of the battle to the present time. Heroic sculptured figures will be installed on the roof of the museum on each side of the monument.

From El. 89 to the top of the shaft deep flutings occur on each of the four main faces which give a pleasing effect and make the monument an outstanding feature artistically and distinct from other monuments of its kind.

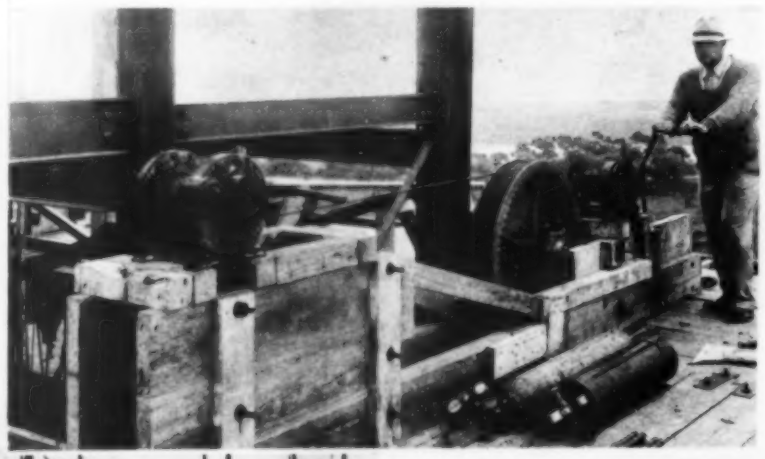
An elevator is installed inside the shaft and makes the trip from the ground floor to the observation gallery in approximately 2 min.

Scaffold — A construction feature that has proved of great interest to those who have visited the site is the scaffold arrangement which is used for the placing of the stone facing from the roof of the museum to El. 89 and, in modified form, from El. 89 to the top of the shaft. The accompanying front view of the structure shows the two steel towers erected inside the shaft and extended, as work progressed, to the top. One of these towers constitutes the permanent framework around the elevator shaft and the other, a companion tower, was dismantled after the completion of the construction program.

Around these two steel towers was built a suspended scaffold built up of a network of I-beams, the two main members being 24-in. I's, at 74 lb. This scaffold, when loaded, weighs 128,000 lb. An accompanying photograph, taken from the roof of the museum, shows this construction. The scaffold is suspended from the four outer corners of the steel towers by 8 sets of cables passing around sheaves and attached to 8 differential drums, the drums being attached to 8 hand winches, 4 of which lift the scaffold easily and the remaining 4 are for safety. When a lift of 24 ft. has been made and it is desired to move up the lifting winches, slings are placed around the main girders so that at no time are there less than two sets of cables at each corner holding up the platform. Two close-up photographs show the arrangement of the winches by which the scaffold is raised and lowered, and the manner in which the suspension cables are attached to the main 24-in. I-beams.

The initial expense for this equipment was heavy but has undoubtedly been fully justified by the ease with which operations are carried forward and the unusual safety provisions which are afforded. The scaffold can be brought to any level desired, the men can work on the inside and

READY FOR CONCRETING SHAFT at El. 54. Note reinforcement in place between inside wood forms and limestone veneer serving as outer forms. Top of limestone is grooved for anchorage to concrete. Metal ties extend from inner wood form to outside edge of stone facing.



HAND WINCHES, of which eight were used by contractor, raised scaffold suspended by cables from outer corners of steel towers.

LIMESTONE VENEER is set around concrete frame while hoist operator is guided by directions spoken into microphone hung on chest of foreman.

SUPPORT FOR SCAFFOLD (right), is furnished by eight sets of cables passing around sheaves and attached to differential drums on hand winches.

outside of the wall and the scaffold kept at a constant distance from the face of the outside as well as the inside wall, even when these faces, as in this instance, are built on a batter.

Another of the close-up photos shows a stone about to be seated on the stone course already in place. Attention is drawn to the foreman who gives directions to the operator of the hoist by means of a breast microphone. This method of communication between the operator of the hoist and the foreman in charge of the placing of all stone has worked admirably and has greatly speeded up the operation of the placing of these stones in the 6-ft. courses.

Below El. 89 the stones used for facing weighed approximately 7,000 lb. each and were handled with a Chicago boom attached to the steel tower. Above that elevation the size decreased until individual pieces weighed about 500 lb. These smaller stones were set by raising them on the building cage to the top scaffold and then lowering them by means of a hand-operated stone derrick to their place in the wall below. These stone derricks were equipped with casters so that they could be easily moved from place to place on the scaffold.

Sequence of Operations — A day's operation consisted of first placing the horizontal and vertical reinforcing steel to a height several feet above the top of the wall; next, setting a course of stone completely around the shaft; building a set of forms on the inside of the wall; raising the scaffold a height of 2 ft.; and then pouring 2 ft. of concrete. This pouring operation was repeated three times in about 4 hr., making a total of 6 ft. of shaft poured and faced each day. This progress was maintained consistently since work on the fluted section of the shaft started. For the holding of the forms and the stone during the pouring of the 6-ft. height of wall, wire ties were used, extending from the back of the wood forms through the bed of the stone course and fastened to a wood waler on the outside of the stone. After the concrete had set these ties, each containing a crimp, were twisted off back of the concrete.

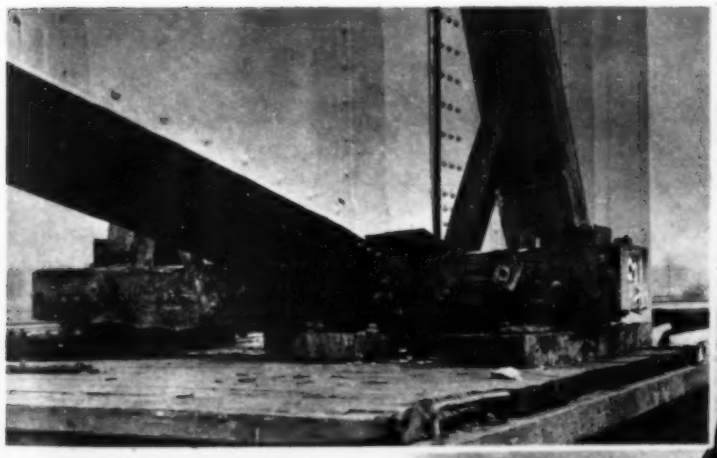
Another view shows the top of the shaft at El. 54 and clearly shows the reinforcing steel in place preparatory to the pouring of the next 6-ft. section of concrete. In the photograph will be noted the continuous groove in the top of the stone for insertion of the galvanized anchors, 2 ft. on centers each way, which tie the facing to the concrete shaft. This added precaution was taken, though it was demonstrated that a splendid bond was developed between the concrete and the stone, and extensive tests have proved that the Texas limestone used is not stained by the concrete, even when the latter is poured directly against the stone.

The fact that the entire job was constructed under a PWA grant, using relief labor, speaks well, we think, for the many precautions taken to forestall accidents of all kinds.

Alfred C. Finn, of Houston, was the architect of the structure, and the contract was awarded to the W. S. Bellows Construction Co., of Houston, for $758,000 and called for completion in 400 working days. C. A. Bullen was superintendent in full charge of the construction program.

Extensive landscaping work is being done in the adjoining park which, when completed, will furnish an outdoor stage and accommodation for seating 5,000 people. There will also be a reflecting pool 220 ft. wide and 2,000 ft. long flanked on each side by stately trees, providing a suitable setting for the shaft. All of this landscaping is being done as a Works Progress Administration undertaking.

Large Bridge Girders Require Special Loading Methods

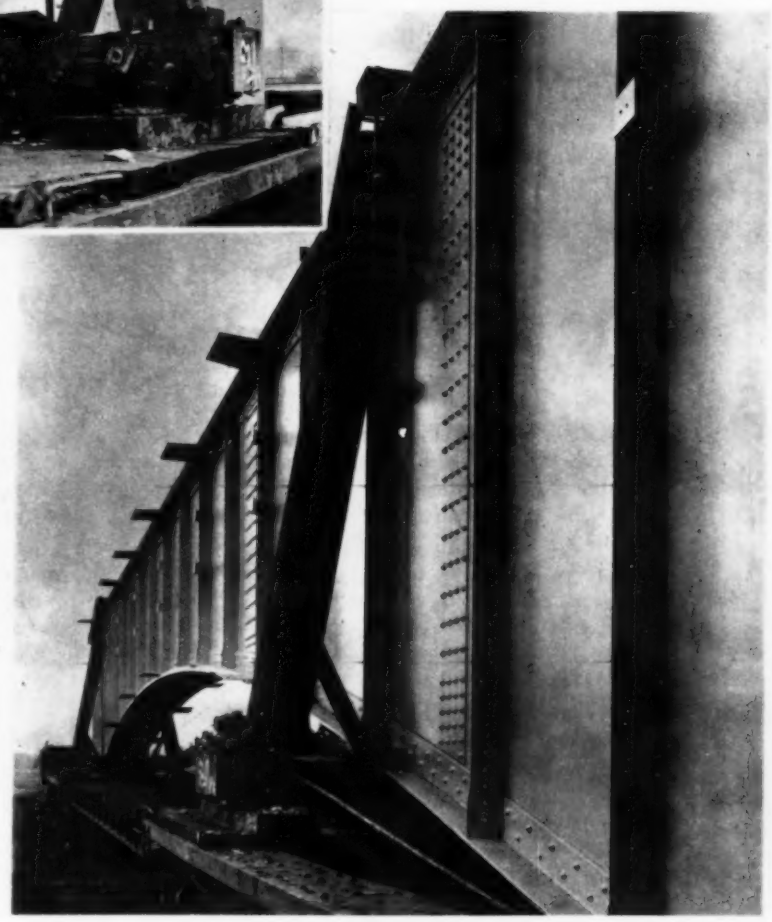


DETAIL OF BLOCKING used to hold pairs of 38-ton girders on flat cars.

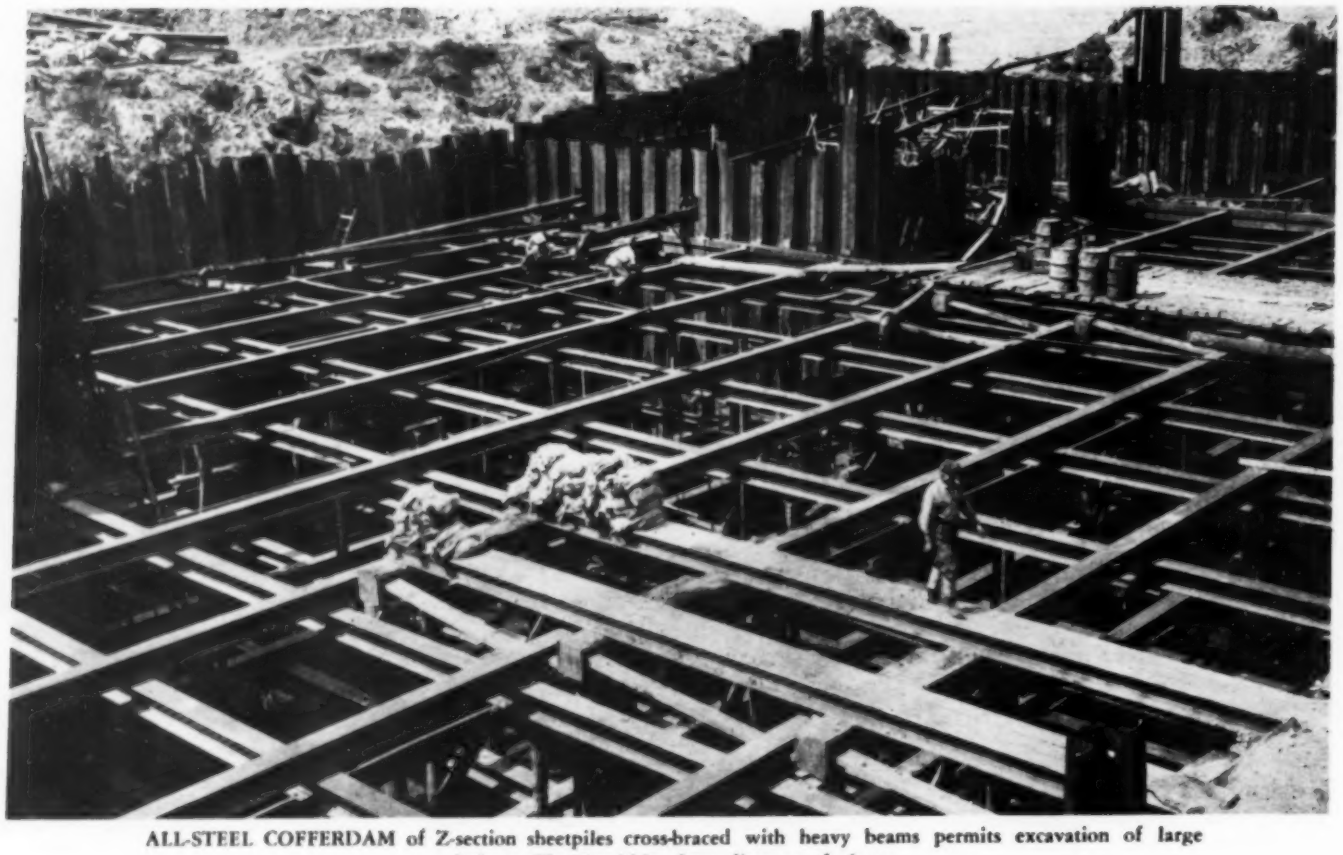
SPECIAL loading methods were called for in the shipment of eight large service bridge girders made at the Chicago works of Bethlehem Steel Co. for the new Mississippi River dam at Le Claire, Ia. These girders were 105 ft. 5 in. long and weighed approximately 38 tons apiece. They were shipped by rail to Davenport, Ia., where they were loaded on barges and transferred to the dam site.

Two girders were loaded side by side on three steel underframe flat cars, a 52-ft. flat car in the middle serving as an idler, with a well-hole flat car at each end. The latter were 45 ft. long and 10 ft. 2 in. wide, and had a well opening 25 ft. 2 in. long and 7 ft. 8 in. wide; the height from rail to deck floor was 4 ft. 3⅝ in. This gave a height of 18 ft. ⅛ in., and a width of 6 ft., and with this clearance it was found necessary to route the shipment via Belt Railway of Chicago to South Chicago; Chicago, Rock Island & Pacific Railway to Clearing; Belt Railway of Chicago and Chicago, Milwaukee, St. Paul & Pacific Railway to Davenport, Iowa. Clearances of 18 ft. 2 in. in height from top of rail to top of load and 10 ft. wide to top of load had been obtained from these roads.

In order to clear a 15-deg. curve on the Belt Railway of Chicago it was necessary to leave the gusset plates off the bottom flanges of the girders in the well of the flat car. Due to the nature of the load it also was decided to use heavier material than the minimum requirements for securing girders vertically on pivoted bolsters on flat cars, as specified in the loading rules of the Association of American Railroads.



THREE FLAT CARS (left) were used to carry pairs of 38-ton girders 105 ft. 5 in. long. At each end were well-hole cars, with idler car between them.



ALL-STEEL COFFERDAM of Z-section sheetpiles cross-braced with heavy beams permits excavation of large hole to El. -36 within short distance of river.

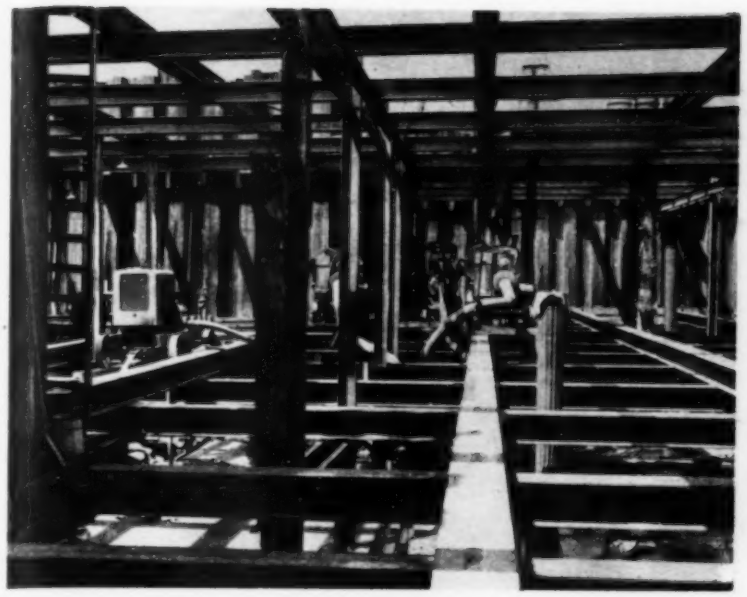
All-Steel Cofferdam

Protects Open Excavation for Sewage Plant Pumping Station

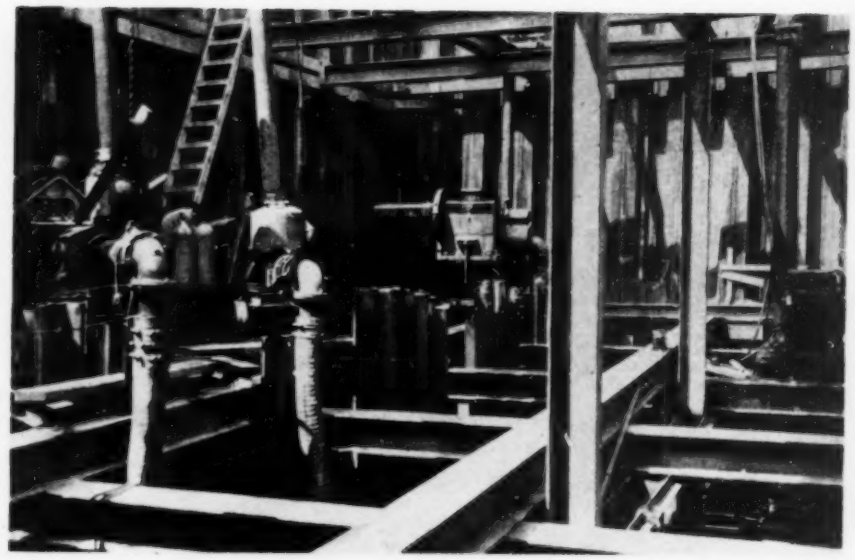
PERFECTLY ALIGNED WALLS of steel Z-section piles are supported by wales made up of double steel girders. Upper wale rests on brackets, while lower wale hangs on steel straps.

OPEN EXCAVATION of a large hole to El. -36 and of a smaller internal hole to El. -50 for the pumping station of a new sewage treatment plant on Bird Island in the Niagara River, Buffalo, N. Y., required heavy sheeting and bracing which the Hockensmith Contracting Co., Albany, N. Y., supplied by driving steel walls made up of Carnegie-Illinois sheetpiles of ample section modulus and by supporting these walls with steel cross-bracing utilizing wide-flange beams exclusively for both struts and wales. Acting as subcontractor for foundation excavation under the Bryant & Detwiler Co., Detroit, Mich., holder of a general contract with the Buffalo Sewer Authority, the Hockensmith organization inclosed the larger area, measuring 145x110 ft. in outside dimensions, with heavy steel Z-piles of maximum available section modulus, driving the sheetpiles to El. -45 and excavating inside the cofferdam to El. -36. As excavation proceeded, the contractor installed cross bracing at El. -14 and El. -30. For the deeper foundation of an intake well located inside the large cofferdam, the contractor sank a 45x25-ft. pit to El. -50, sheeting the pit with arch-web steel piles and bracing the

BEYOND COFFERDAM inclosing pumping station excavation, power shovel and piledriver carry on foundation construction for grit chamber in large, open pit sheeted with horizontal timber lagging placed between steel H-piles.



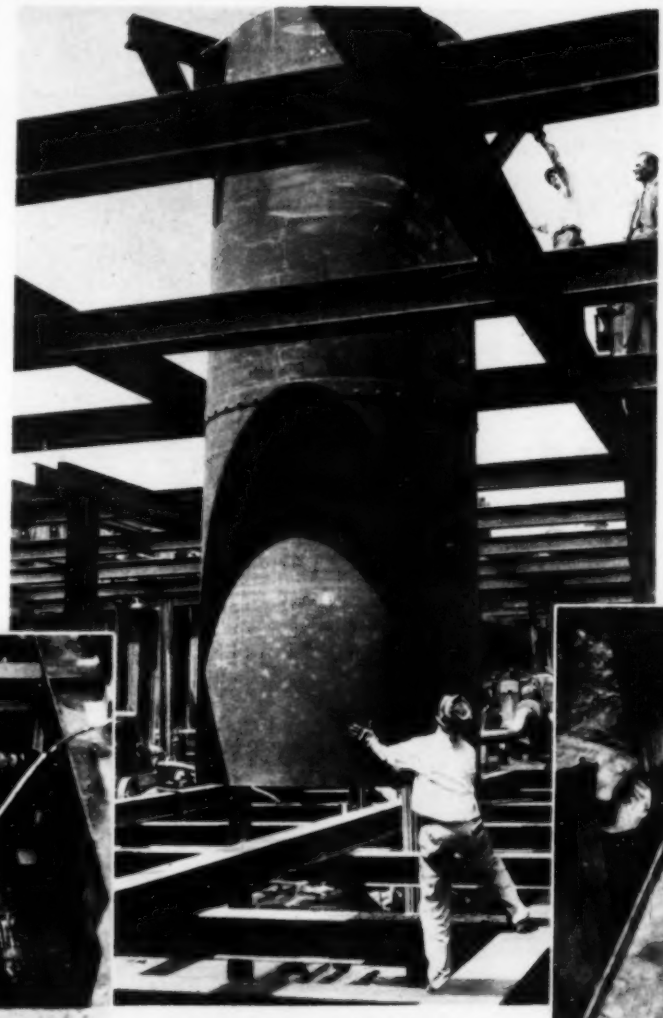
INTERIOR OF LARGE COFFERDAM, excavated to El. -36. Three 8-in. centrifugal pumps in background remove water from sump. Corrugated steel-shell piles have been driven to test foundation bearings. Deep pit inside secondary all-steel cofferdam is located just beyond small pump at left.



FOUR PUMPS, comprising electric-motor-driven 12-in. deep-well turbine pump at right and three gasoline-powered 8-in. centrifugal units on platform at left, are operated as required to remove 6 to 8 m.g.d. from deep hole.

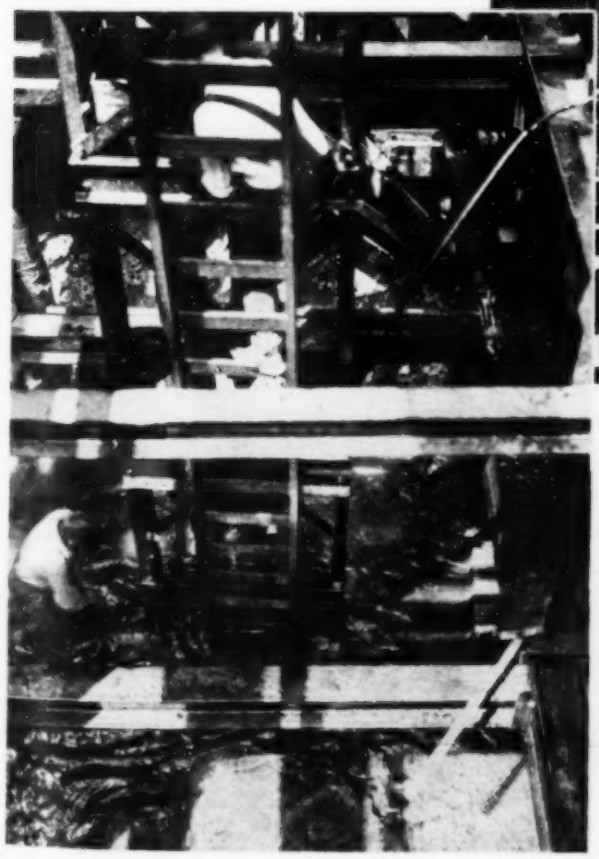
walls at two levels with steel wales and struts.

Contrary to what had been indicated by preliminary test borings, excavation inside the two cofferdams failed to uncover gravel at El. -36 and bedrock at El. -45. Instead, the contractor found soft muck and fine sand at El. -36, shattered rock at El. -42 and boulders at El. -45, with no sound rock in evidence even at El. -50, where a seamy bottom admitted 5,000 to 6,000 g.p.m. into the smaller cofferdam. To investigate foundation possibilities further, the engineers in charge ordered the contractor to sink two 7-ft.-diameter steel cylinder caissons from El. -36 into the boulder formation, a distance of about 10 ft. After sinking one 7-ft. cylinder to El. -46 without encountering bedrock or any hard material, it was decided to drive 10-in. 57-lb. H-section bearing piles. These piles were driven to solid bearing at various depths from El. -50 to El. -56. The contractor drove a total of 370 H-piles in 8 days of three shifts per day.

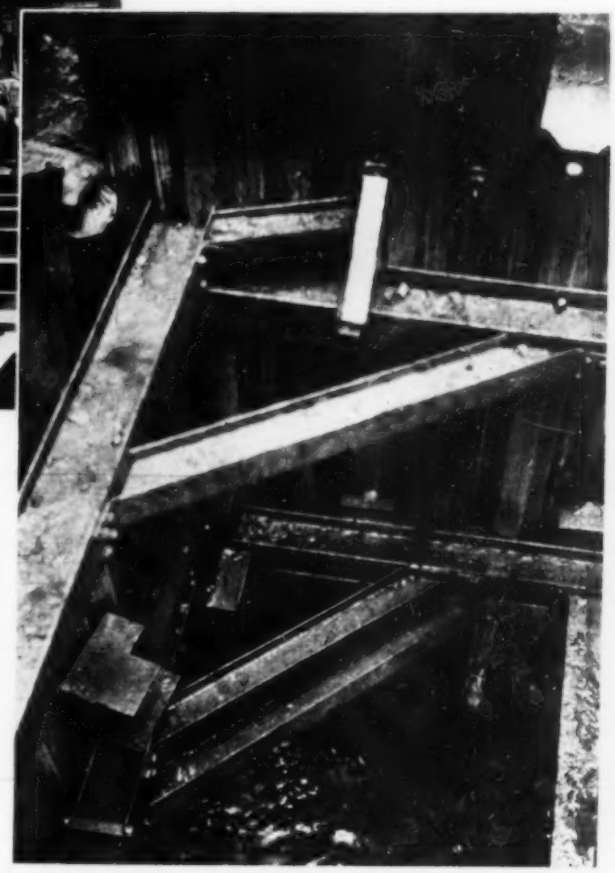


EXPERIMENTAL CAISSON is lowered into place at El. -36 to permit extending excavation into boulder formation for purposes of additional foundation investigation.

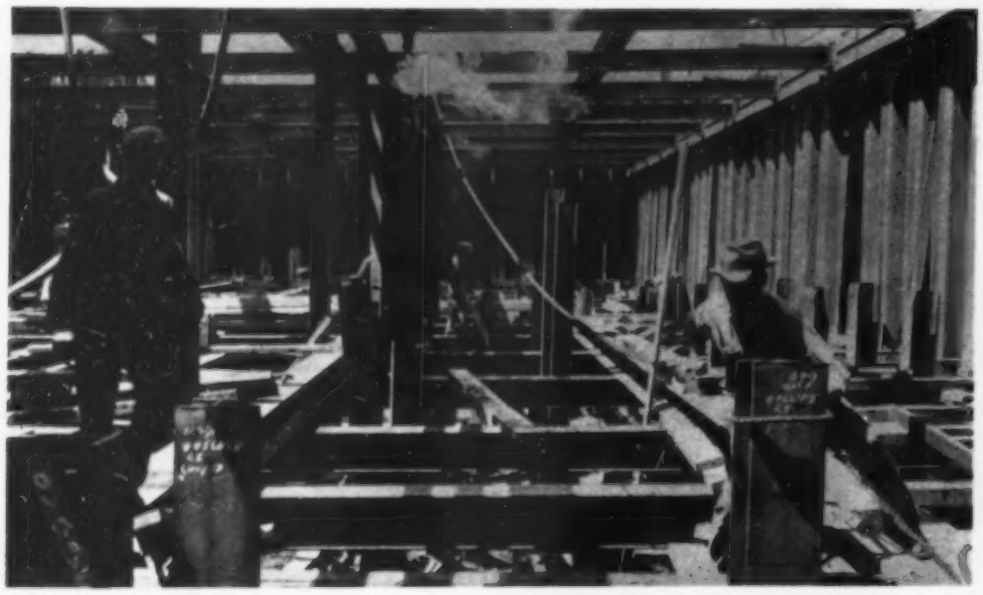
Z-piling forming the walls of the large cofferdam has an arch depth of 11½ in. and a section modulus per foot of wall of 38.3 in.^{3} Except for the side adjoining the grit chamber, the cofferdam is sheeted with piles 46 ft. long, driven to El. -45. Excavation for the grit chamber made it possible to reach the same depth with 33-ft. piles in the adjacent cofferdam wall. Wales at the upper bracing level (El. -14) are made up of two 12-in. 45-lb. wide-flange beams. Struts, placed 10 ft. c. to c. in the north-



DEEP-WELL TURBINE PUMP in secondary steel cofferdam lifts water from sump at El. -50.



CORNER BRACING reinforces steel wales of secondary cofferdam, in which excavation for inlet chamber is carried from El. -36 to El. -50.



STEEL H-PILES 24 ft. long figured for bearing capacity of 50 tons per pile are driven to refusal on rock.

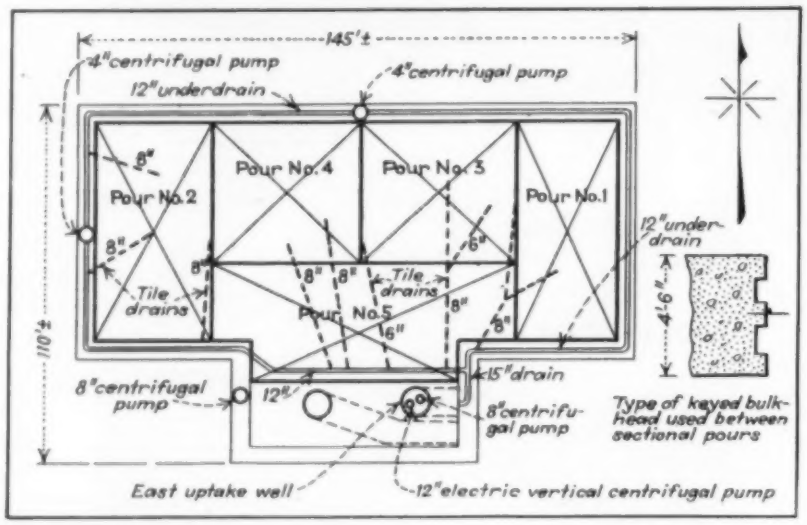
LARGE STEAM WHIRLER *(below)*, with 85-ft. swinging derrick boom, handles excavation and materials for good part of cofferdam area.

south direction and 12 ft. c. to c. in the east-west direction, are 12-in. 65-lb. wide-flange beams. The lower bracing frame at El.-30 (1½ ft. above top of slab in the wet well) utilizes two 12-in. 64-lb. wide-flange beams for each wale and 14-in. 95-lb. wide-flange beams for struts.

Eight gasoline-powered 8-in. centrifugal pumps and one electric-motor-driven 12-in. deep-well turbine pump were installed at the site to take care of inflowing water. The contractor used the 12-in. deep-well pump, with a capacity of 8,000 g.p.m., and three of the 8-in. centrifugals, with capacities of 2,200 g.p.m. each, to lift water from the boiling bottom of the deep pit, operating the latter units to hold down the water level when moving the large pump. To remove inflowing water from the upper bench, El.-36, three 8-in. centrifugal pumps were mounted on the cofferdam cross-bracing and were used as required to pump from a sump. Outside the cofferdam two additional 8-in. centrifugals took care of seepage from the river, which flowed past the site less than 60 ft. away from the cofferdam. Normal water level in the river at this point is El.-5 to -8.

A large steam whirler derrick (equipped with an 85-ft. steel swinging boom) and two crawler cranes operating on timber-pile trestles handled all excavation from inside the cofferdam with clamshell buckets. A buried rock-filled timber crib running through the site retarded both driving of sheet-piles and excavating. This crib, 20 ft. wide at the base, 16 ft., high and 16 ft. wide at the top, consisted of 12x12-in. timbers with dovetailed joints held together by wooden pins. The crib ran north from the pumping station through the grit chamber and sedimentation tanks, where the Hockensmith Contracting Co. handled excavation and piledriving under the same subcontract agreement.

Concrete Footing Mat—A reinforced-concrete mat 4½ ft. thick was placed around the heads of the cut-off steel H-piles on the bottom of the



DRAINAGE SYSTEM consisting of 12-in. headers and 6-in. to 8-in. laterals transfers water from gravel subgrade to sumps for pumping out of hole. Concrete is placed on dry bottom in five pours of about 300 cu.yd. each.

excavation at El.-36. To facilitate drainage of the subsoil, consisting of fine sand and silt, the engineers decided to remove a 6-in. layer of this material below subgrade and refill with well graded, washed gravel. Around the outside edge of the footing slab, their drainage scheme utilized a main line of 12-in. underdrains terminating at the east uptake well in the inlet chamber. As the gravel was placed, a system of lateral tile drains was added in those areas where fine sand, washing into the voids of the gravel, closed some water courses in the coarse material and reduced its drainage capacity.

DRY BOTTOM at El.-36 is provided by system of main drains and tile laterals taking groundwater out of 6-in. gravel backfill. Steel piles have been cut and capped to permit placing of 4½-ft. reinforced-concrete mat.

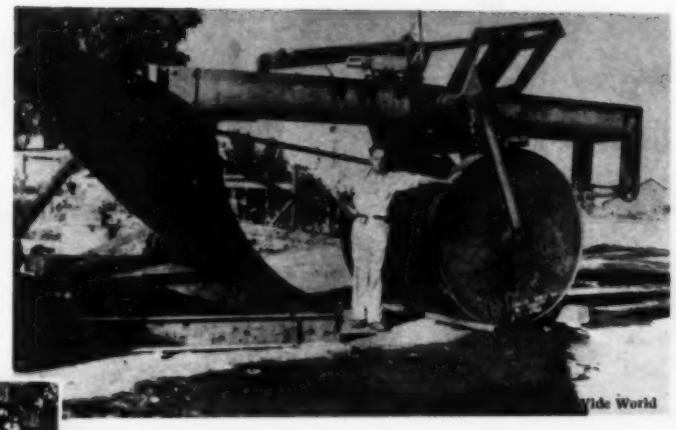
Locations of the main drains and lateral drains are shown in the accompanying sketch. The constructors attempted to drain the entire area into the east uptake well of the inlet chamber, but this purpose was not fully accomplished because of insufficient slope in the drains. Two additional sumps with a small pump in each then were installed along the main drain, as indicated on the sketch.

For the footing mat a total of 1,400 cu.yd. of concrete and 152,000 lb. of reinforcing steel was required. To avoid any possible damage to the mat caused by stoppage of the drains during the concreting operation, the program was arranged to permit pouring in five sections of about 300 cu.yd. each. Pours were made on successive days, and only 8 days' time was required to complete the slab from the date when the first section was ready for reinforcing steel. During this period, the contractor employed a night shift of carpenters and rodmen.

A double keyway with a sheet-metal water stop was provided between sections of the mat, as indicated in the drawing. No signs of leakage have been noted through these joints under a 10-ft. head of water.

Administration—The sewage treatment plant, costing about $4,500,000, is being built as part of the Buffalo Sewer Authority's current $15,000,000 sewerage program to stop pollution of waters in and around the city. Greeley & Hansen, Chicago, are the Authority's designing and supervising engineers, and J. K. Giesey is engineer of construction in charge of the treatment plant for this firm. George Hockensmith directs operations of the Hockensmith Contracting Co., Albany, N. Y., while W. M. Robinson is superintendent of construction for the Bryant & Detwiler Co., Detroit, Mich., general contractor.

GIANT PLOW (right) capable of turning furrow 6 ft. deep and 2½ ft. wide, brings to surface in Southern California rich top soil buried by thick layer of sand deposited by flood waters of Santa Ana River. In absence of Paul Bunyan, legendary lumberman colossus of Northwest woods, (to whose memory huge concrete statue at right margin of this page has been erected) big plow, designed by C. R. Post, of Santa Ana, Calif., is hauled by three 95-hp. crawler tractors.



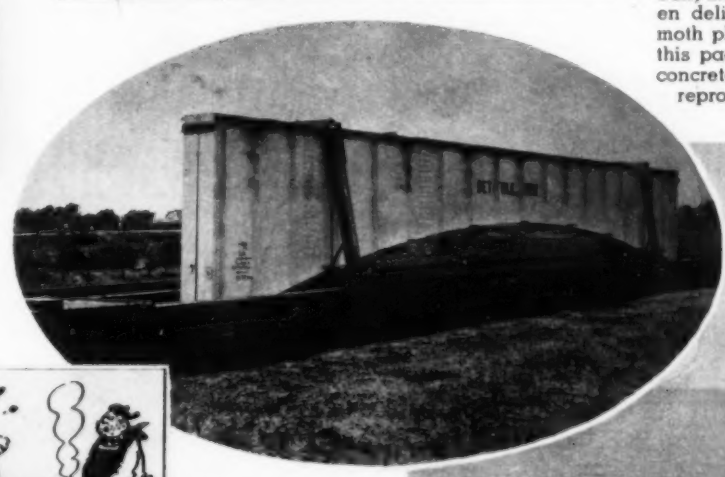
JOB ODDITIES

A MONTHLY PAGE OF

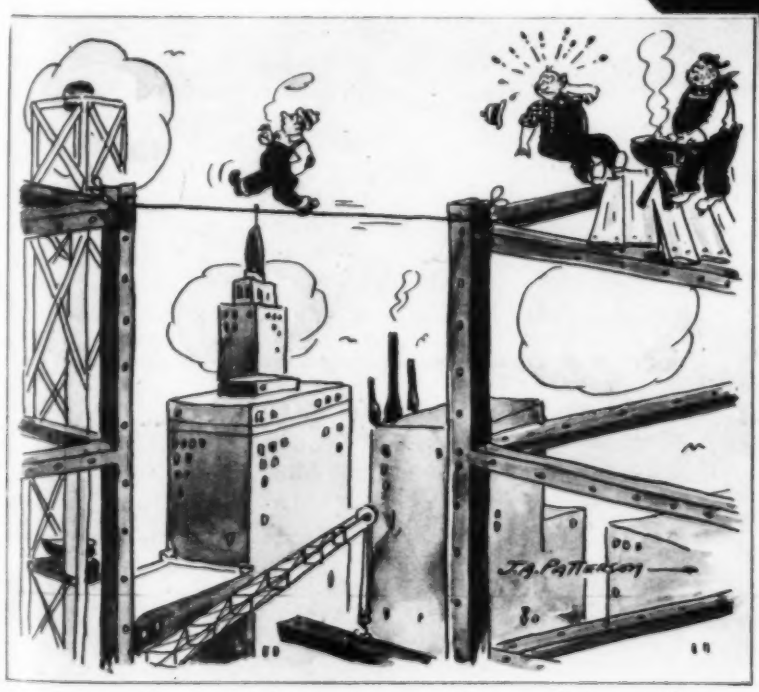
Unusual Features of Construction

CONCRETE COLOSSUS is erected on shore of Lake Bemidji, in Beltram County, Minn., to perpetuate memory of legendary giant lumberman, Paul Bunyan, who would have taken delight in operating mammoth plow illustrated at top of this page. Statue is of colored concrete, with logger's shirt reproduced in bright hues.

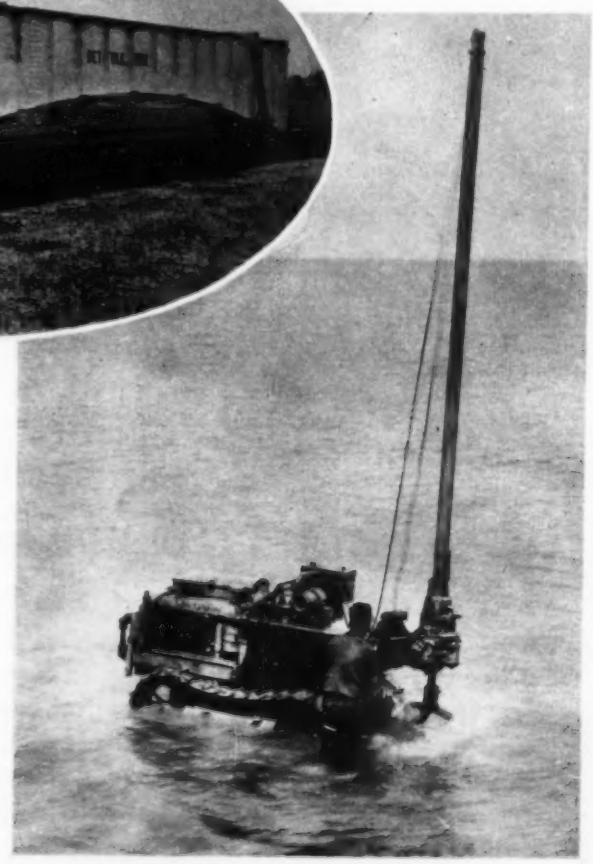
MAKE YOU HUNGRY? This road direction sign in Kent, England, speaks for itself. It attracts much attention from motorists passing spot.



ARCHED SHAPE is applied to 38-ton plate girders, 105 ft. long, shipped by Bethlehem Steel Co. on three flat cars from Chicago to Le Claire, Ia., for erection in service bridge at new Mississippi dam.



"That's the way he's been acting ever since some fortune-teller told him he has a charmed life."



SUBMARINE TECHNIQUE is required of this Caterpillar tractor working at site of seawall construction at North Beach, Md. Equipped with auger, outfit is putting down holes 16 in. in diameter and 9 ft. deep.

HARRISON BEATS WINTER BY SHIFTING HIS JOB *into High* WITH ..

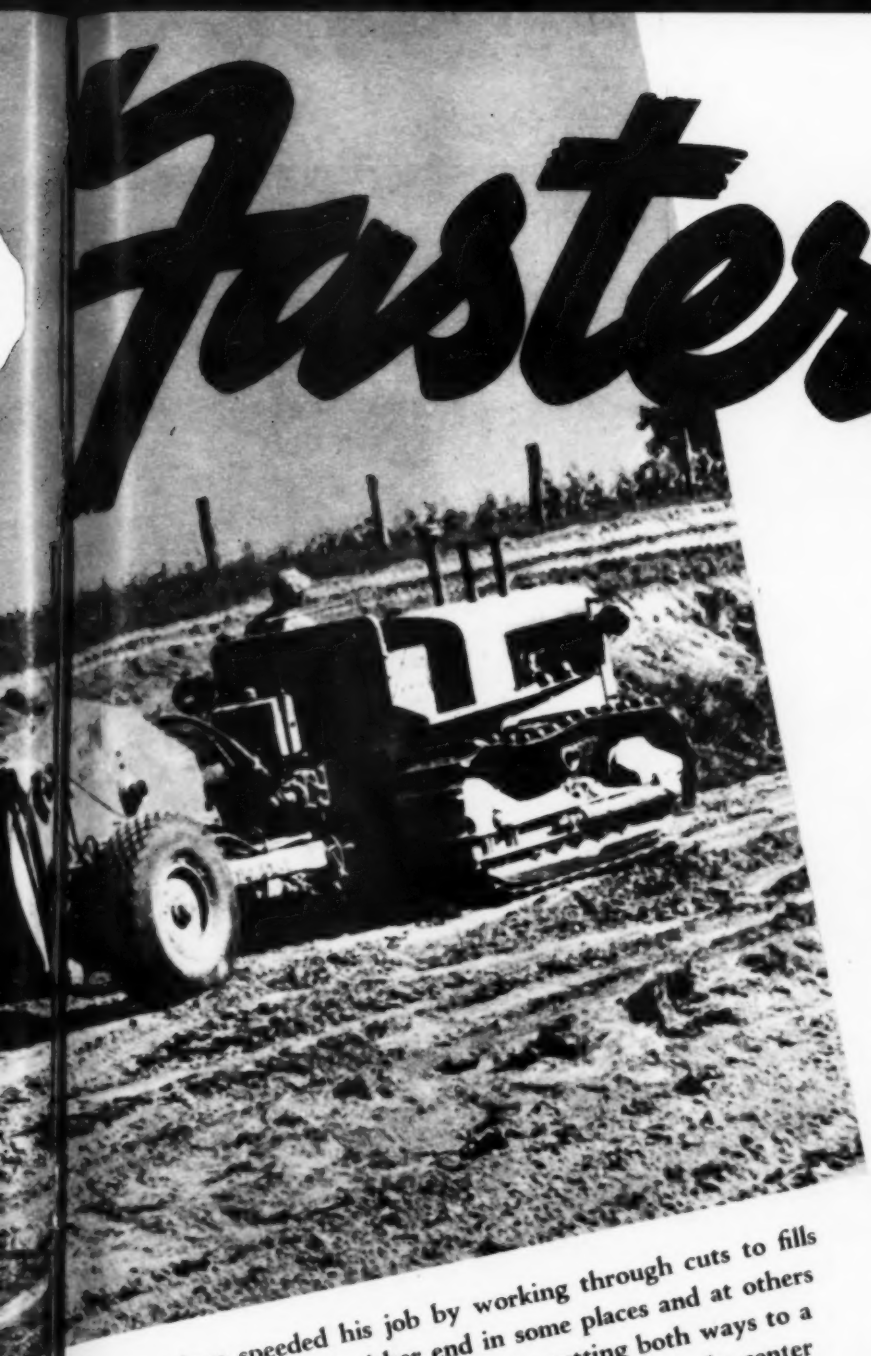
LOWER COST PER YARD WITH *Faster Power*

Fuel savings begin with the cost per gallon. A-C Controlled Ignition Oil tractors develop a full, even flow of power on any regular Diesel fuel or furnace oil. **No extra-cost, premium fuels or special engine lubricating oils are required. As a result A-C users normally save from a cent to 3 cents per gallon on fuel and from a fourth to a third on lubrication costs.** That fuel does more work, too, because the ***Faster Power*** of A-C tractors makes more trips per shift and moves more yardage per horsepower. Compare the performance and cost of ***Faster Power*** with slower-moving conventional tractors. See for yourself how it lowers unit costs.

Model K and Baker bulldozer trimming up along the side of a fi

Model L and 7-yd. Continental backing to end dump around culver

Faster Power



Harrison speeded his job by working through cuts to fills at either end in some places and at others by cutting both ways to a fill in the center

When Harrison Engineering and Construction Corp., began the job August 30 of realigning and paving 7.9 miles of State Route 64 near Maquoketa, Iowa, *fast work* was necessary. The project called for 171,000 cu. yds. of excavation. It was planned to have half of that and 3 miles of paving completed before the winter shutdown. To meet this schedule Harrison put three Allis-Chalmers tractors—***Faster Power***—on the job. Much of the excavating was in the black top and compacted gravel of the old road, but A-C's reserve lugging power quickly put full loads in the Continental scrapers—scarifying was unnecessary. ***Faster Power*** in the higher working speeds shortened the time between cut and fill, enabled Harrison's rigs to make many extra trips each shift. A-C's easy maneuverability and the end dumping of the scrapers made possible important savings in backfilling around culverts and in other tight spots. By Thanksgiving, when winter forced a shutdown, Harrison had graded 5½ miles and was well ahead of the planned schedule ... thanks to A-C's ***Faster Power.***

Many other contractors, like Harrison, are finding that ***Faster Power*** saves them time and increases output from start to finish. Their A-C tractors start instantly and go right to work—no fussing with or waiting on auxiliary motors. Their equipment moves faster because A-C tractors have more and higher speeds—that means greater flexibility and the right speed for every task. They move bigger yardages per horse power because A-C design eliminates speed-robbing dead weight. They gain extra trips hourly because A-C tractors move faster in the higher speeds at which 90% of all construction is done. Shift your job into high with ***Faster Power.***

ASK YOUR NEAREST A-C DEALER TO SHOW YOU WHAT *Faster Power* CAN DO FOR YOU.

ALLIS-CHALMERS

TRACTOR DIVISION—MILWAUKEE, U. S. A.

Yesterday: Banking Office — Today: Radio Studio

Cleveland Building Remodeled Without Noise By Arc-Welding

REMODELING and alteration work on existing buildings is accomplished today for a great deal less cost than formerly and with a minimum disturbance to tenants. It used to be almost prohibitive to attempt alterations which required connecting any large amount of new steel work to the existing frame. In order to connect the new steel it was necessary to expose the old steel from two sides. This costly supplementary work, over and above the cost of actually connecting the steel, plus the disturbing racket of making connections, has given way to a new method — noiseless electric welding. This modern process permits connecting new steel work to the frame of an existing building without the need for removing masonry except on one side of the existing member, and without the use of an intermediate or connecting member.

Fig. 1 . . . **BANKING QUARTERS (right)** in first stages of alteration. New steel work is connected to existing columns by arc-welding.

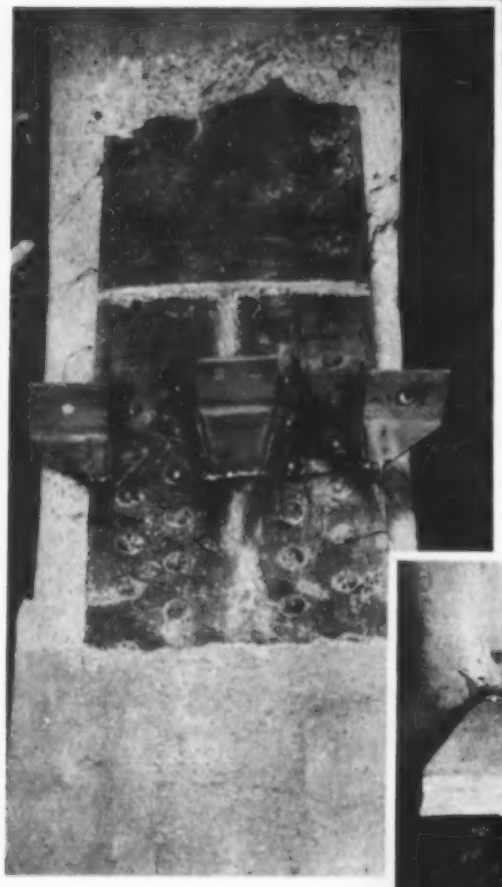


Fig. 3 . . . **ONE TYPE OF SEAT** used in connecting new steel to old columns. These seats consist of angles arc-welded in place.

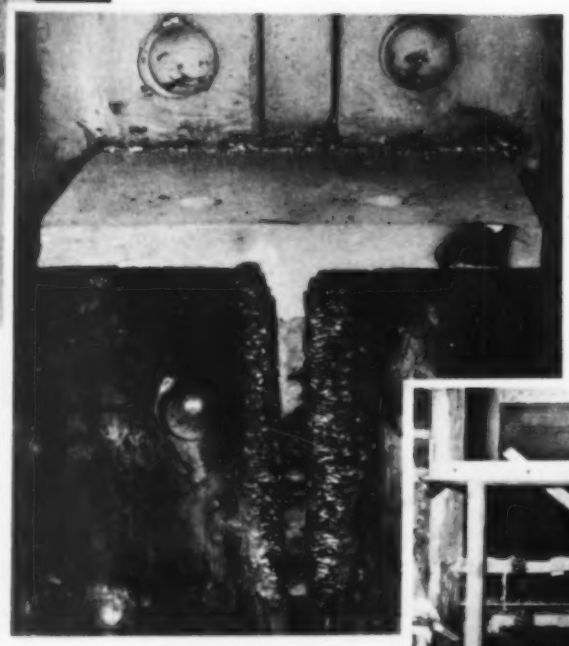


Fig. 5 . . . **CLOSE-UP** showing split I-beam section seat arc-welded to web of old column.

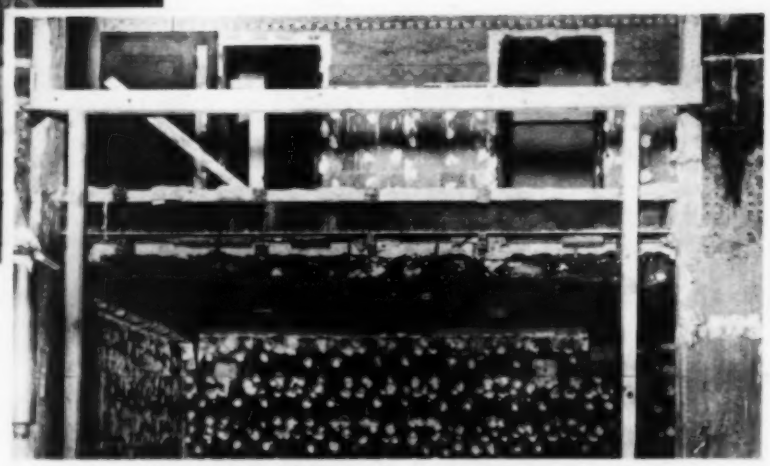


Fig. 4 . . . **WOODEN TEMPLET** is used to obtain accurate location for the seats which were arc-welded to existing columns to support the new girders.

A recent example of the application of electric welding to the remodeling of a building is a former banking office in Cleveland, Ohio, which has been altered to accommodate an N.B.C. radio broadcasting

studio. The location is the first floor of a 19-story building.

The remodeling consisted of transforming the banking quarters, consisting of cashiers' cages along both sides, with a balcony above, into a two-storied area divided into small individual broadcasting rooms on the first floor and a larger open area on the second floor. The banking office in the early stages of the remodeling work can be seen in Fig. 1. A view taken from the same position as Fig. 1, but showing the new steel work erected, is provided in Fig. 2. When the photo for Fig. 1 was taken, the work of remodeling had progressed to the point where the masonry had been removed from the existing columns to permit attachment of seats for the new girders.

Fig. 3 illustrates the type of seats which were arc-welded to the old columns to carry the new girders. The two outer seats served as supports for the struts running along the side of the room between the columns.

To determine the proper location for the girder attachments to the columns, a special templet made out of wood was used. This is illustrated in Fig. 4.

Split I-beam seats were used in the manner illustrated in Fig. 5. This seat was arc-welded to the old columns by a continuous bead of weld metal entirely around the section, both sides of the flanges and web. The welding of a split I-section connection to a column can be seen in Fig. 6. The shielded arc-process of electric welding was employed, using equipment manufactured by

Fig. 2 . . . **30 TONS** of new steel is welded to old columns without noise of riveting hammers to disturb tenants of building over new broadcasting studio.

Fig. 6 . . . **MODERN STEEL CARPENTER** joins steel to steel silently.

Fig. 7 . . . **NEW SUB-COLUMN** arc-welded to base plate.

The Lincoln Electric Co., Cleveland, Ohio.

A close-up showing the method of placing the new sub-columns is shown in Fig. 7. The arc-welded connections of the columns to the base plate were made by a continuous bead of shielded-arc weld metal entirely around the joint on both sides of the web and flanges.

A total of 30 tons of new steel was erected. There were two 21-in., 142-lb., 35-ft. WF beams; one 21-in., 122-lb., 25-ft. WF beam; one 21-in., 103-lb., 25-ft. WF beam; two 18-in., 47-lb., 18-ft. WF beams; eight 16-in., 45-lb., 18-ft. WF beams; Twenty-eight 12-in., 19-lb., 12½-ft. light beams; one 12-in., 32-lb., 12½-ft. light beam; eleven 12-in., 32-lb., 12½-ft. light beams; three 12-in., 22-lb., 12½-ft. light beams; five 12-in., 25-lb., 18-ft. columns; and one 12-in., 32-lb., 18-ft. column.

All the steel was fabricated by electric welding in order to avoid any error in working out the details of the connections. There was no need to line up rivet holes in the fabricated members with the holes in the existing steel. This would have been virtually an impossibility inasmuch as the original detailed drawings, showing the location of the rivets, were not available. All that the steel fabricator had to work from was a drawing showing the locations of the existing columns. By using welded connections it was possible to do the work without touching the old rivets. The seats for the new steel connecting to the old were attached by staying inside the rivet lines. The fabrication of the new steel consisted of little more than cutting the ends of the new I-beams to fit into the web of old columns and attaching beam and girder seats to sub-columns.

If welding had not been used it would have been necessary to drill out the old rivets and use new steel sufficiently heavy to permit connecting with the same size rivets which were originally used. Not only would heavier members have been required but the noise of riveting would have been telegraphed directly to the roof of the building via the columns.

This remodeling work was done by The Austin Co., of Cleveland, for the National Broadcasting Co. The new quarters are to house Station WTAM.

RIGGING PROBLEMS

Solved in Handling and Installing Heavy Machinery at Boulder Dam

By G. H. FARREN

Contract Service Department, General Electric Co., Schenectady, N.Y.

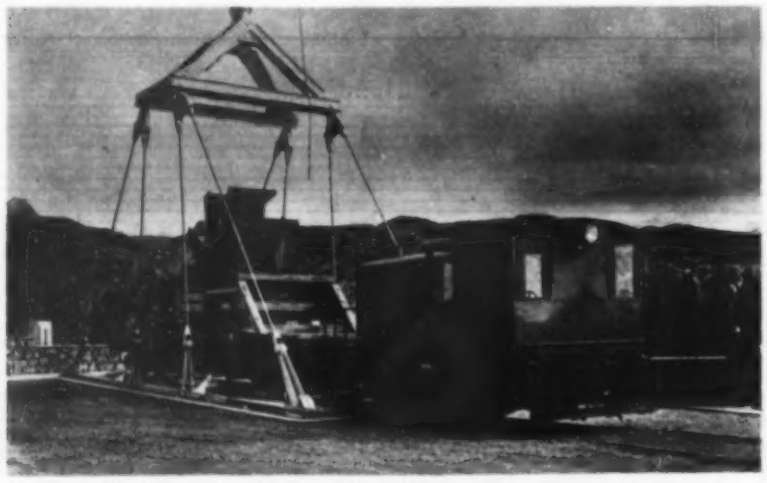
CONCRETE WEDGE 727 ft. high, forming Boulder dam, impounds water feeding power houses on both Nevada (left) and Arizona sides of canyon.

EVEN THOUGH the construction of Boulder dam was completed last year and the spectacle of watching the highly efficient equipment used to place the millions of 76 tons, was the largest single piece tory, nearly 75,000 visitors from all over the world come each month to see this engineering masterpiece. They are fascinated as they watch the material used in the construction of the largest vertical generators and hydraulic turbines ever manufactured being moved from the railhead at Boulder City to the power house 700 ft. below the rim of Black Canyon.

This material is delivered by the Union Pacific Railroad to the U. S. Bureau of Reclamation at Boulder City, about 10 mi. from the dam site. From there it is handled by the government over its own tracks and cableway to the floor of the power house. A 30-ton Davenport-Besler type 0-6-0-locomotive, equipped with a Le Roi 224-hp., 8-cylinder engine is used to haul the loaded cars down to the rim of the canyon, where they are placed on a specially built skip directly under the Government-owned cableway; they are then lowered to the power house level of the canyon.

The cableway is a track of six 3½-in. cables at 18-in. centers, 1,200 ft. from wall to wall and anchored in concrete-filled tunnels 80 ft. deep.

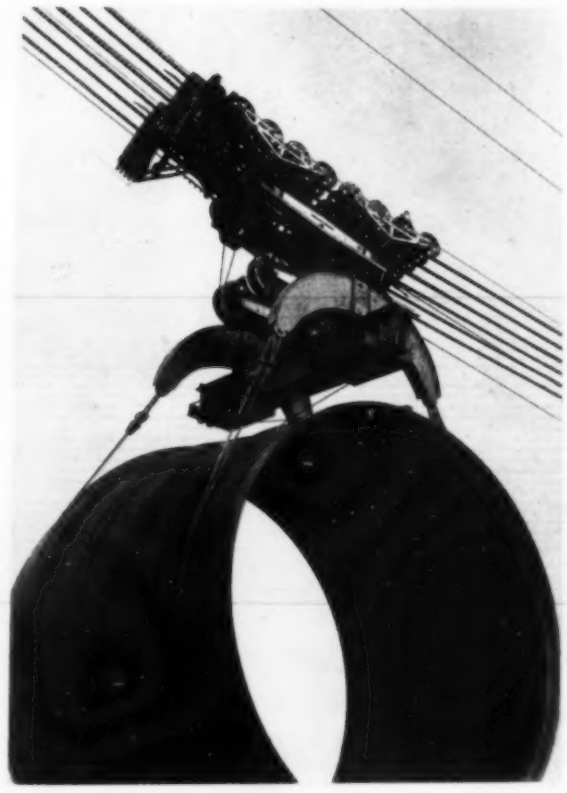
BOX CAR (above) is landed by cableway at power house on Nevada side.



CABLEWAY SKIP is loaded with equipment on flat car of skeleton type, ready for lowering 700 ft. to power-house level.

Photos, U. S. Bureau of Reclamation

"MOON BEAM" (right) on cableway trolley handles large, heavy sections of steel penstock.



The track carriage, with 48 wheels, weighs 19 tons. There are two hoist drums each 13 ft. in diameter and 17 ft. long, each carrying a mile of cable in one layer. This cableway has a capacity of 165 tons and a speed of from 20 to 120 ft. per minute, furnished and installed by the Lidgerwood Manufacturing Co. It is driven by two motors of 175 and 400 hp., direct current, and operated by remote control from any one of five stations.

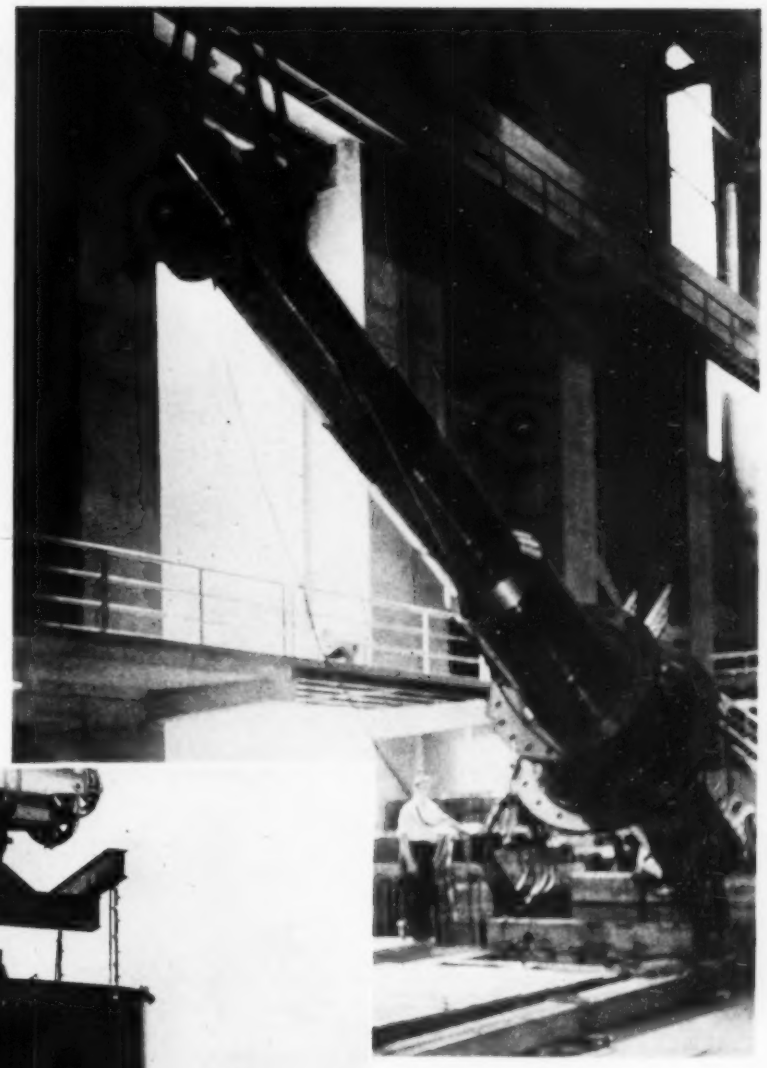
The cars can be landed on either the Nevada or the Arizona side of the canyon, at the main floor level of the power house, in specially built pits and from there switched into the power house for unloading.

There are two power houses, one on the Nevada side of the river and the other on the Arizona side, 650 ft. long and 80 ft. wide. The Nevada power house will have, when completed, eight 82,500-kva. generators and one 3000-kva. house set. The Arizona side will have seven 82,500-kva. generators, two 40,000-kva. generators and one 3,000-kva. house set. At this writing four of the large generators in the Nevada side are completed and in service, and on the Arizona side one 40,000-kva. generator is installed and in service. The house sets supply light and power for the project and for Boulder City.

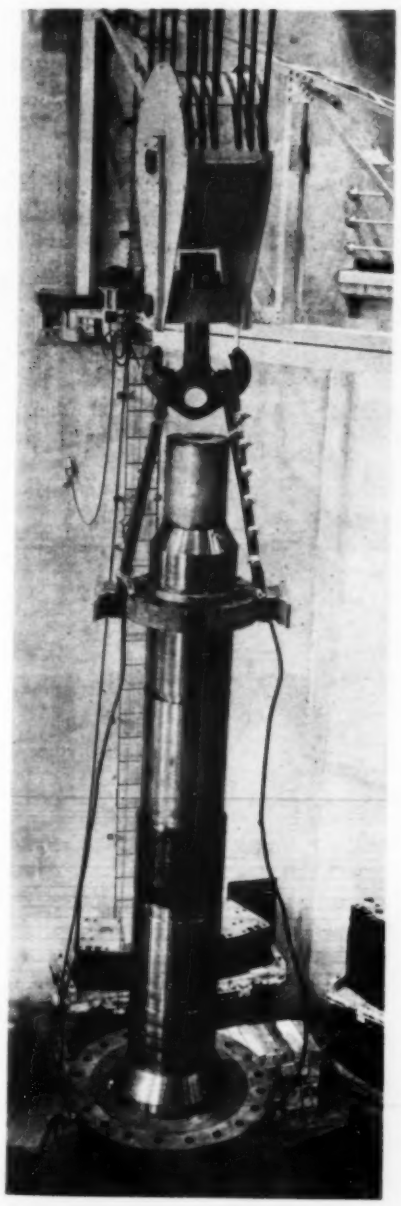
On the main floor of each power house there are two 350-ton cranes each equipped with two 175-ton hooks and two 35-ton hooks. The 175-ton hooks have a speed of 4 ft. per minute and the 35-ton hooks travel 20 ft. per minute. There is 42 ft. headroom above the generator-room floor and each hook will reach the bottom of the wheel pit, a distance of about 80 ft. There is a 50-ton crane in the central section and each governor gallery has a 25-ton crane, as there are very few places in the power house that cannot be reached by one or more cranes.

The 350-ton cranes have two carriages each having one 175-ton hook and one 35-ton hook with the large hooks together on the inside. Because of the weight and size of some of the pieces of equipment, both large hooks are quite often used. There are many lifts of over 100 tons, the greatest being the generator rotating field, weighing 630 tons. To handle this great weight a special lifting beam was provided.

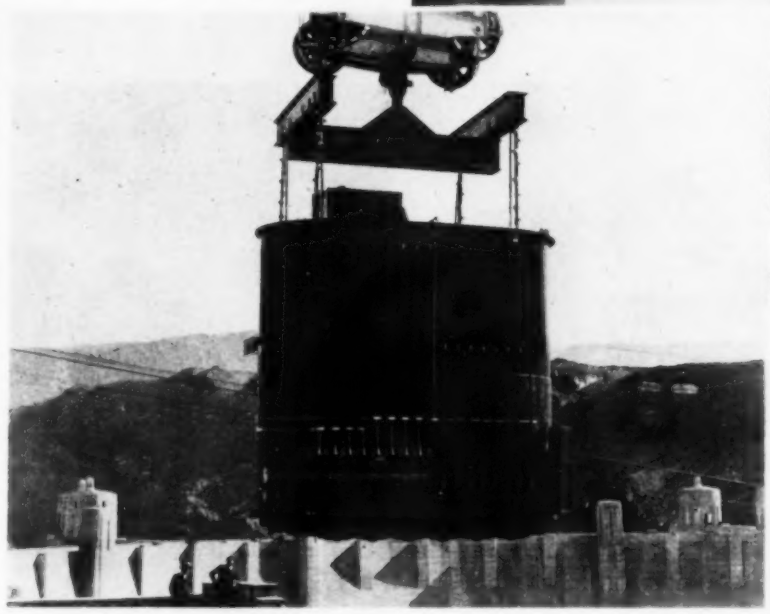
This device consists of three separate beams: Two small beams, one for each crane, are used to tie the crane hooks together; they are 16 ft. long, 4 ft. high and weigh 9 tons each, with 14-ft. centers between hooks. A large beam is used to connect the two cranes and to carry the



UP-ENDING 65-ton shaft, heeled on 12x12-in. soft pine timbers.

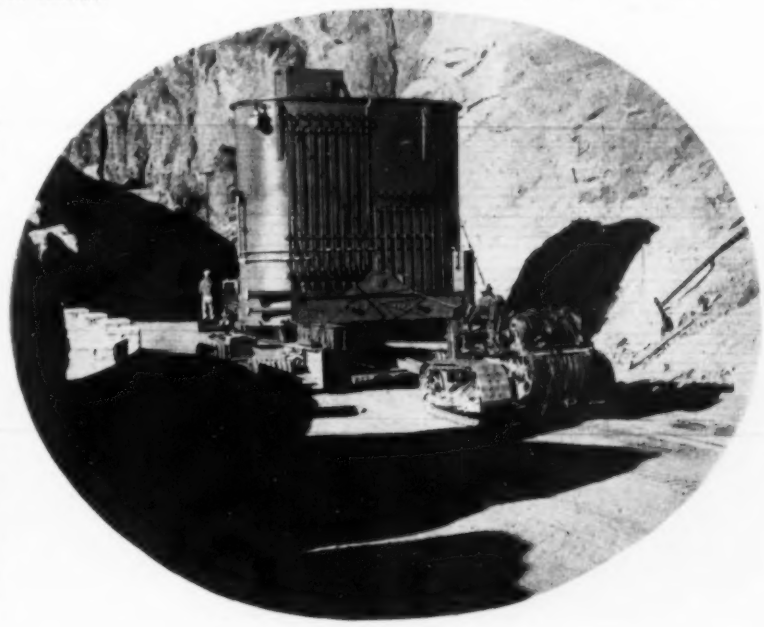


LIFTING TRUNNION used to up-end 65-ton shaft, using 6-part, 1¼-in. cable. Limited headroom made close hitch necessary.

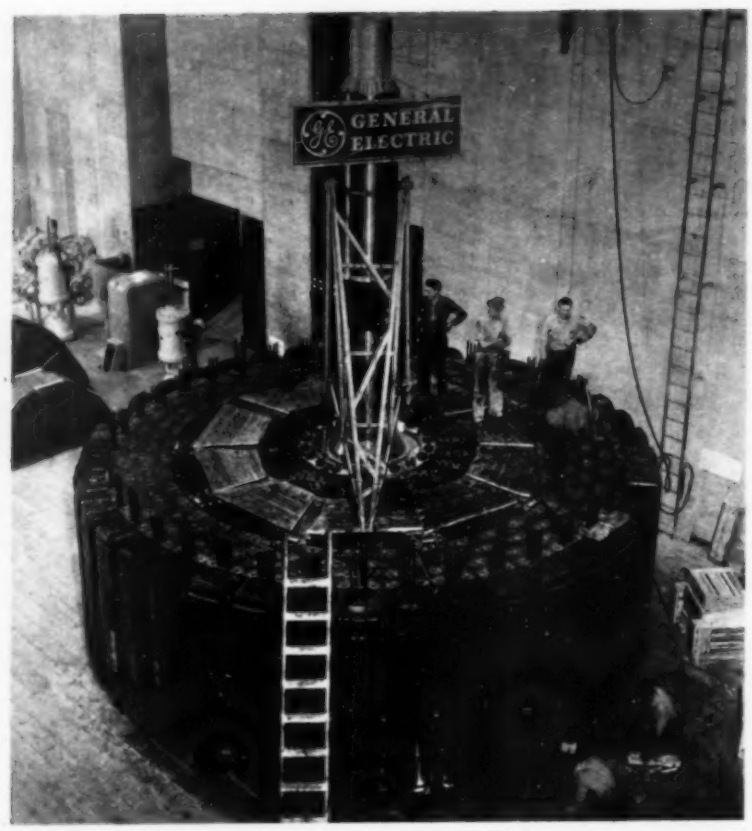


HEAVY TRANSFORMER, suspended from special lifting beam on cableway, starts 700-ft. descent into canyon.

TRANSPORTATION (below) of 125-ton transformer down 7 per cent grade is handled by special trailer with capacity of 200 tons.



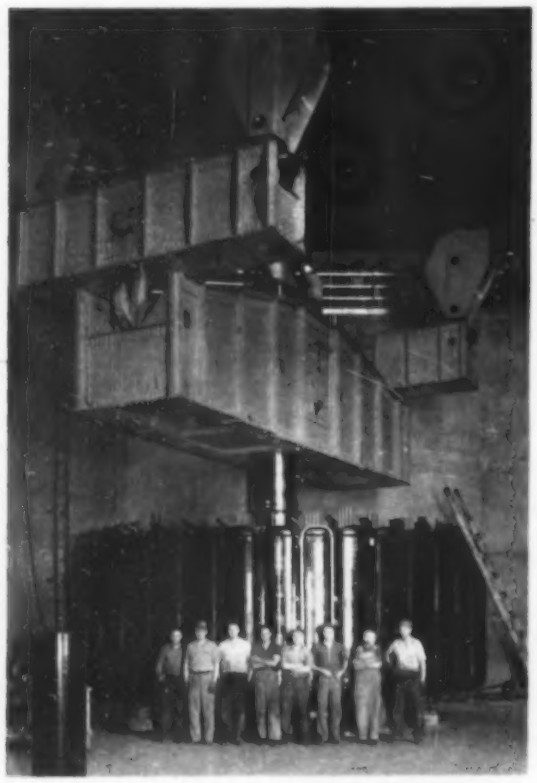
ROTATING FIELD. 28 ft. in diameter and weighing 600 tons is moved into place at Boulder dam power house. Four 175-ton crane hooks handle total load of nearly 700 tons.



SIXTEEN CARS were required to transport material for assembly into this 600-ton rotating field, largest ever built.

load; this beam is 31 ft. long, 9 ft. high, with 28-ft. centers between hooks and weighs 36 tons. To pick up the load the cranes are linked together at both ends of the bridge, the end of the shaft is threaded through the center beam and a 3-in. circular key takes the thrust on a roller bearing. This bearing allows the load to be turned into position

TWO 350-TON CRANES. (right) close-coupled, were required to place the first 600-ton rotating field.



LIFTING BEAM (left) is keyed to 600-ton rotating field.

at the time the field is placed in the machine. Each crane and hook are separately controlled and each beam has a level indicator giving the operator complete control of the load.

The shaft, with a shipping weight of 76 tons, was the largest single piece of equipment received. It was shipped on a special 16-wheel car, and was lowered to the power house by the Government-owned cableway. This shaft is 36 ft. 9 in. long, 41 in. in diameter at the hub fit and weighs about 65 tons. A sleeve-type lifting trunnion lashed to the crane hook with six parts of 1½-in. cable was used to up-end it. It was then carried the full length of the power house to the assembly pit where the upper hub was shrunk in place. Electric strip heaters were used to expand the fit 1 mil per inch of diameter of the shaft. The field rim, consisting of about 300 tons of steel plates, was assembled in place and to this 40 field poles weighing 5 tons each were keyed. This gave a total weight of over 600 tons, stated by the Government guides as being the heaviest piece of equipment ever lifted inside a building.

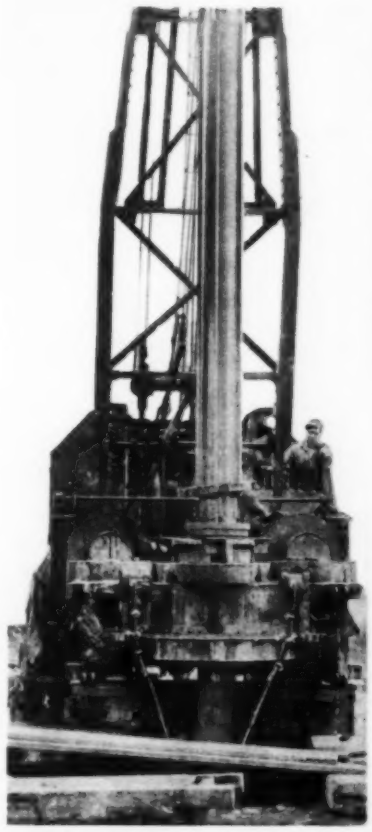
The seven 55,000-kva., 287,500-volt transformers were assembled about 2 mi. from the rim of the canyon, moved down a 7-per cent grade on a 200-ton trailer equipped with power steering and air brakes, aided by trucks and tractors. This 125-ton load was also lowered to the power house on the Government-owned cableway, placed on a transfer car and moved to the transformer bay outside the generator room.

Boulder dam was built for and under the supervision of the U. S. Bureau of Reclamation, the power houses being completed and equipment, other than the generators, being installed by Government employees. The generators were installed by the manufacturers. The photographs herewith are part of the pictorial history of the construction of Boulder project and are supplied through the courtesy of the U. S. Bureau of Reclamation.

DRILL RIGS put down caisson holes close to walls of existing power station. Crane in left foreground handles sections of pipe casing ranging from 5 to 6½ ft. in diameter.

Caissons Sunk by

ROTATING STEEL SHELLS



DRILL STEM of machine passes through rotary table driven by large gear actuated by bevel pinions from pair of 75-hp. motors.

ROTARY BIT for cutting through soft ground has teeth on three arms that can be adjusted to fit size of hole desired.

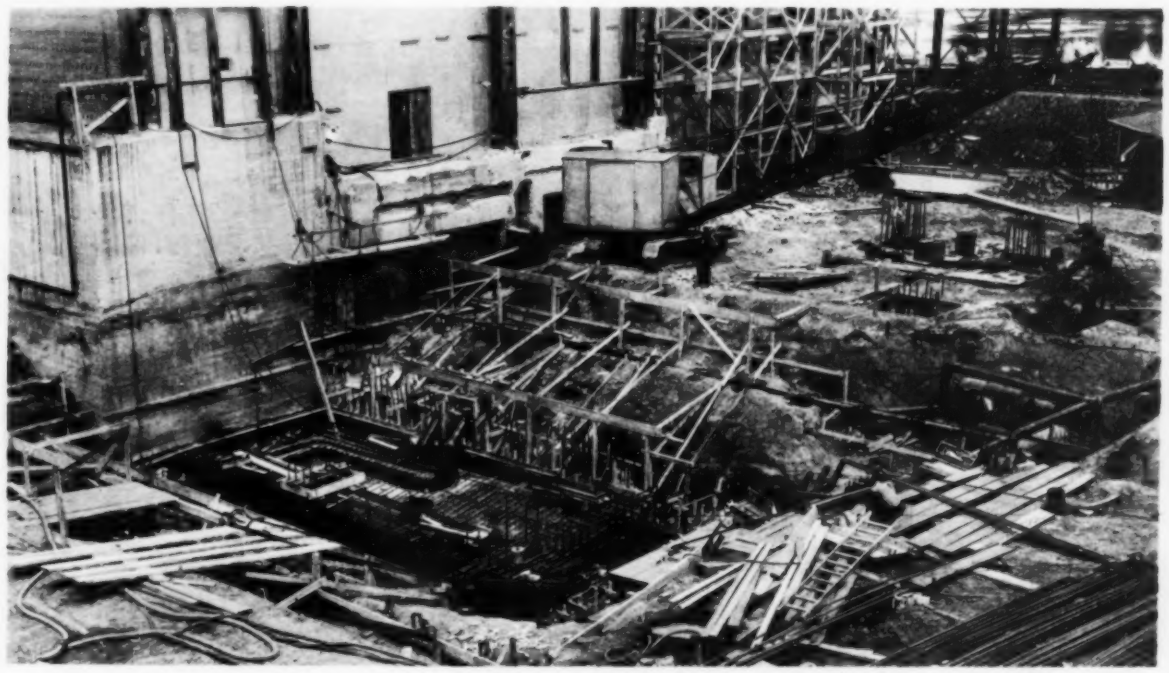
CAISSONS of a special type, involving the use of cylindrical steel shells, lowered into mud-filled holes excavated by rotating bits, were sunk to depths of 110 ft. to support, without settlement, the substructure of an extension to the South Meadow station of the Hartford Electric Light Co., in Connecticut.

Bedrock was about 110 ft. below ground. It was covered by about 10 ft. of hardpan bearing water under considerable pressure head, 65 ft. of very soft clay, 25 ft. of sand and gravel, and the remainder miscellaneous sand and fill. The caissons were of various sizes, the smallest being 5 ft., and the largest 6 ft. 6 in. in diameter. Due to the considerable depth and the nature of the strata the Powell method, described below, was used in sinking the caissons for foundation construction.

In this method a cylindrical area slightly larger than the finished diameter of the caisson was drilled through the earth down to the hardpan overlying the rock by a rotating bit. The hole thus formed was kept constantly filled with high specific gravity liquid mud, the pressure and action of this mud preventing any caving of the earth walls around the drilled area. When the hardpan was reached, the rotating bit was withdrawn and a steel shell inserted through the liquid mud to the hardpan, settling readily by its own weight. The lower section of casing was fabricated as a double-wall core barrel, which was rotated to cut through the hardpan and into the solid rock. Chilled steel shot were fed into the cutting edge and the waste material was, for the most part, washed up inside the shell.

When the cylinder was firmly seated in the rock the hole was pumped dry, rocks too heavy to have been washed out were loaded by hand into a bucket and removed, the bottom was inspected and any loose rock removed. Since there was usually some small leakage of water in the bottom, the hole was filled with water and a tremie seal mat of concrete placed, which effectively stopped the flow. The hole then was pumped dry and concreted.

Provision had been made for application of air to the caissons if required, but this was not needed. Stone & Webster Engineering Corp. were engineers for the South Meadow job, on which the caissons were sunk under subcontract with the Caisson Contracting Co., of New York City.



SUBSTRUCTURE (right) for power-house extension is supported on concrete-filled caissons extending down 110 ft. into bedrock.

SAND-BITUMINOUS PAVEMENT

With Traveling Plant Mixers

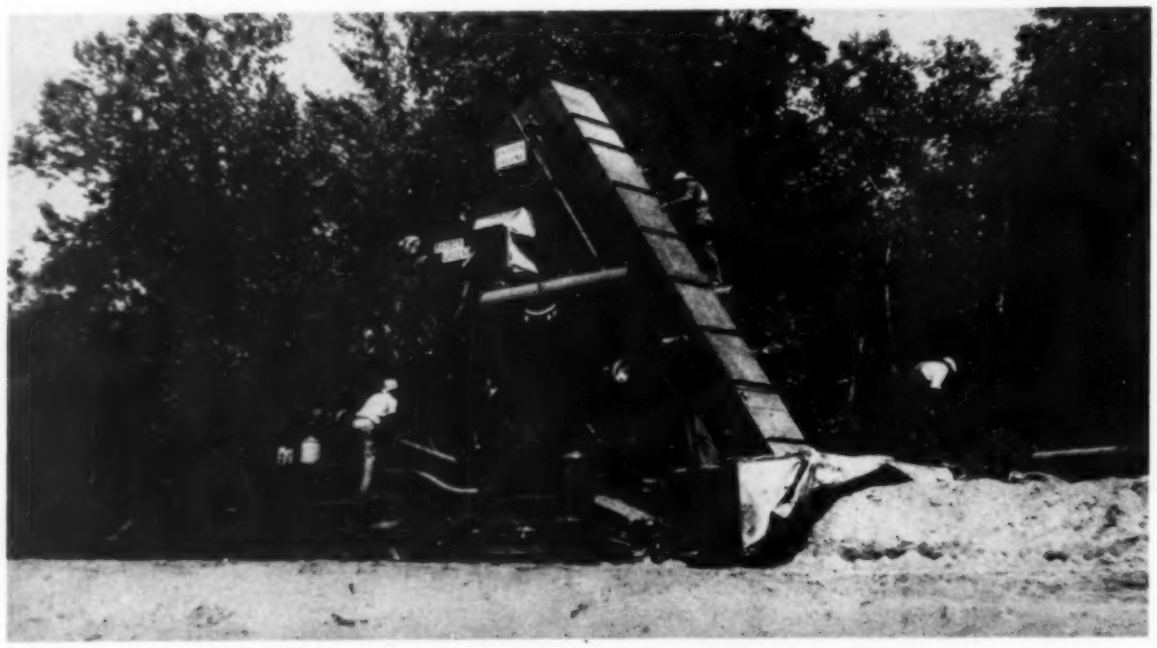
By T. V. FAHNESTOCK

Bituminous Engineer,

North Carolina Highway Commission, Raleigh, N. C.

FOR A NUMBER of years North Carolina has been constructing hot-mix, sand-asphalt pavements in the coastal plain and sand hill sections of the state. These sections cover an area of approximately 22,000 sq. mi. or about 46 per cent of the total land area. In most of this territory sand of suitable quality for use in bituminous pavement is available without unduly long hauls, while in a number of instances sand is found in the right-of-way itself. When this latter condition is encountered, the use of the traveling mixing plants or road-mix methods is especially economical.

In 1935 and 1936 several projects were let to contract for sand-bituminous pavements specifying use of a rapid-curing cutback asphalt as the bituminous material. At the time bids were called for on these projects there were no traveling mixing plants in this territory, and the specifications were prepared with the idea that the pavement would be constructed by mixed-in-place methods, using a distributor to apply the asphalt, together with harrows, blade graders or other similar equipment for mixing. However, the specifications were drawn to permit the use of traveling mixing plants.



TRAVELING MIXING PLANT picks up windrowed sand with bucket loader and delivers it to pug mill where asphalt is added.

Traveling Plant-Mix Methods — The low bidder on sections of 10.94 mi. in Duplin County, and 3.86 mi. in Pender County, decided to use a traveling mixing plant and purchased a Barber-Greene outfit consisting of loader and mixer.

The construction procedure on these projects was identical and proceeded as follows: After fine grading had been completed sand was hauled in and spread on the prepared subgrade, or where sand occurred in the subgrade the grade was left 1 in. higher than the elevation of the finished pavement as shown on the plans. Sufficient sand to construct the pavement was bladed to a windrow in the center of the road. The sand was left spread except for a distance of about 2,000 ft. in front of the mixer, as it could be dried out much more rapidly following rains when spread out.

The machine used on these projects measured both the aggregate and bitumen by volume. It was necessary, therefore, to make moisture and bulking tests on the sand prior to setting the speed for the asphalt pump and the opening on the discharge gate of the aggregate hopper. After proper adjustments had been made it was found that the bitumen content varied very little during a day's run; in fact, this variation was no more than in mixes made in plants where the aggregate and bitumen are weighed.

The machine mixed enough material for a pavement 20 ft. wide and having a compacted thickness of 5 in. at the rate of about 4 lin.ft. per minute, but due to shutdowns while waiting for asphalt or on account of weather conditions was never able to average this production over a day's run. The longest stretch mixed in a 12-hr. period was slightly more than 2,000 ft.

While these projects were under construction the rainfall was considerably above normal, and the frequent rains caused the contractor much delay while trying to dry out the sand ahead of the mixer. This finally became such a serious factor that canvas was used to cover the windrow for 2,000 to 3,000 ft. in advance of the mixer and also for a like distance behind, to prevent the

SECOND OF FIVE WINDROWS is mixed by machine to build pavement 46 ft. wide and 5 in. thick.

STRIKE-OFF BOARD is rigged on front of gathering blades of mixer to control volume of windrow.

newly mixed material from absorbing moisture. The mixed material also was made more resistant to wetting from rain by pulling a heavy steel-shod drag, made in the form of an inverted U, over the windrow directly behind the mixer. This drag helped to glaze the surface of the windrow and cause it to shed water until the weather became suitable for spreading. After mixing, the material was spread with blade graders and harrowed with disk harrows to evaporate the solvent and moisture. Sand having up to 8-per cent moisture at the time of mixing was used without difficulty other than additional manipulation after mixing to dry it out.

The specifications on these two projects called for the top 1 in. of the pavement to have a greater bitumen content than the lower 4 in. The enrichment of the top was done, after the mix from the machine had been dried out and spread, by loosening the top inch with a disk harrow and applying the necessary amount of cut-back asphalt with a distributor. This material mixed with blade graders, spread and rolled to complete the pavement.

The grading of the sand used varied widely, and it was necessary to make changes in the bitumen content accordingly, the average in the base being 4.1 per cent and in the enriched top, 6.0 per cent.

Mixed-in-Place Methods—On two projects in New Hanover and Currituck Counties, constructed in 1937, the Jaeger mix-in-place road builder was used in mixing the sand-bituminous pavement. This machine does not have an aggregate bin but propels the sand directly from the road to the pug-mill mixer by means of blades and spiral gathering screws.

TANK TRUCK delivers fresh supply of bituminous material to mix-in-place machine.

The bitumen content of the pavement depends on three factors: the size of the windrow of sand in front of the machine; the forward speed of the mixer; and the speed of the asphalt pump. Tachometers are provided for indicating the pump speed and the forward speed of the machine. The size of the windrow of sand can be controlled by using a strike-off board across the front of the gathering blades. This strike-off board is fastened to the blades at the proper height to permit the desired volume of sand to be fed to the pug mill. The new Hanover project was constructed as an access road to Wrightsville Beach and the roadbed, as well as the pavement, consists of sand pumped from Wrightsville Sound by hydraulic dredge.

The pavement on this project is 46 ft. wide and has a compacted thickness of 5 in. The sand was very clean for use in a sand-asphalt pavement, containing only 1 per cent passing the 200-mesh sieve; due to this the bitumen content was kept to an average of 4 per cent.

The pavement was constructed by mixing in 5 windrows, following which the mix was spread, aerated with harrows and blades and rolled. It is expected that this pavement will be somewhat soft in hot weather, due to the grading of the sand. It is planned to place a light surface treatment over it before next summer.

On the Currituck project, where the pavement was 18 ft. wide with a compacted thickness of 3 in., the mixer was able to mix all of the material in one windrow. This quantity taxed the capacity of the mixer and it was necessary to place reduction sprockets on the machine, to provide more power by reducing its speed, before satisfactory results were obtained.

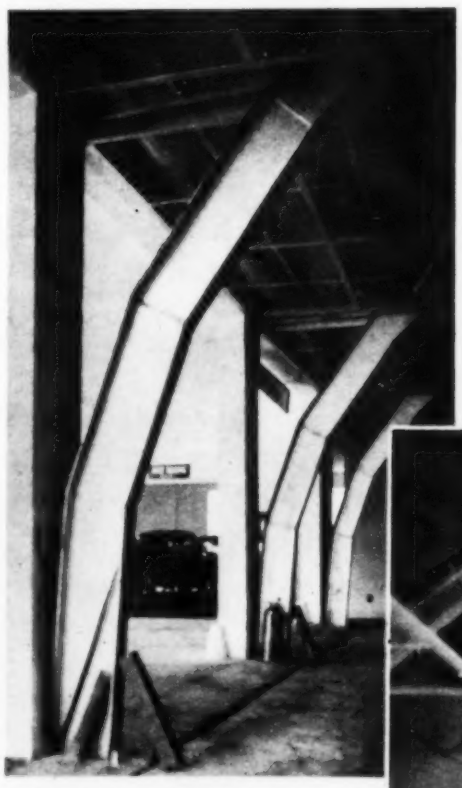
Both types of traveling mixers shown in the illustrations have proved very satisfactory in sand-bituminous work and have made it possible to obtain more uniform bitumen content, as well as eliminating much of the difficulty encountered in constructing these pavements when only harrows and blades are used to do the mixing.

When it is considered that the North Carolina Highway Commission has a total of 18,724 mi. of earth-type roads in the eastern and southeastern portions of the state, most of which are adapted to treatment with some form of insoluble binder, such as bituminous material or portland cement, it readily can be seen that the use of traveling mixing plants has a very definite place in the future of low-cost road construction.

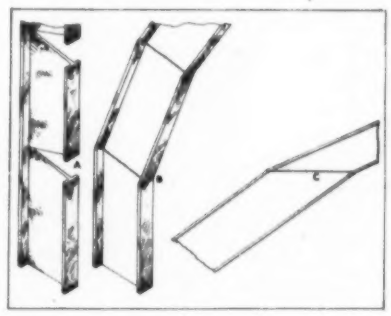
Arched I-Beams *Support Service Station Roof*

TO AVOID POSTS and columns in its Ford service station at Orlando, Fla., the C. & H. Motors Co. employed the form of welded steel arch construction shown in the accompanying illustrations. Width of building is 105 ft., depth, 112 ft. and height about 75 ft. Construction was completed in 60 days.

Each arch is fabricated by cutting V-shaped notches in steel I-beams and bending the outer flange so that the web and inner flange can be welded, as illustrated at the points A and B in the accompanying sketch. Near the top of the arch a lighter I-beam, with a shallower web is used. Here the joint, C, is made by cutting the beam ends at a flat angle so that the flanges match when welded together.



I-BEAMS are notched, bent and welded to form steel arch support for roof, giving unobstructed floor space for service station.



DETAILS (right) of method of notching, cutting and welding steel I-beams to form roof support.

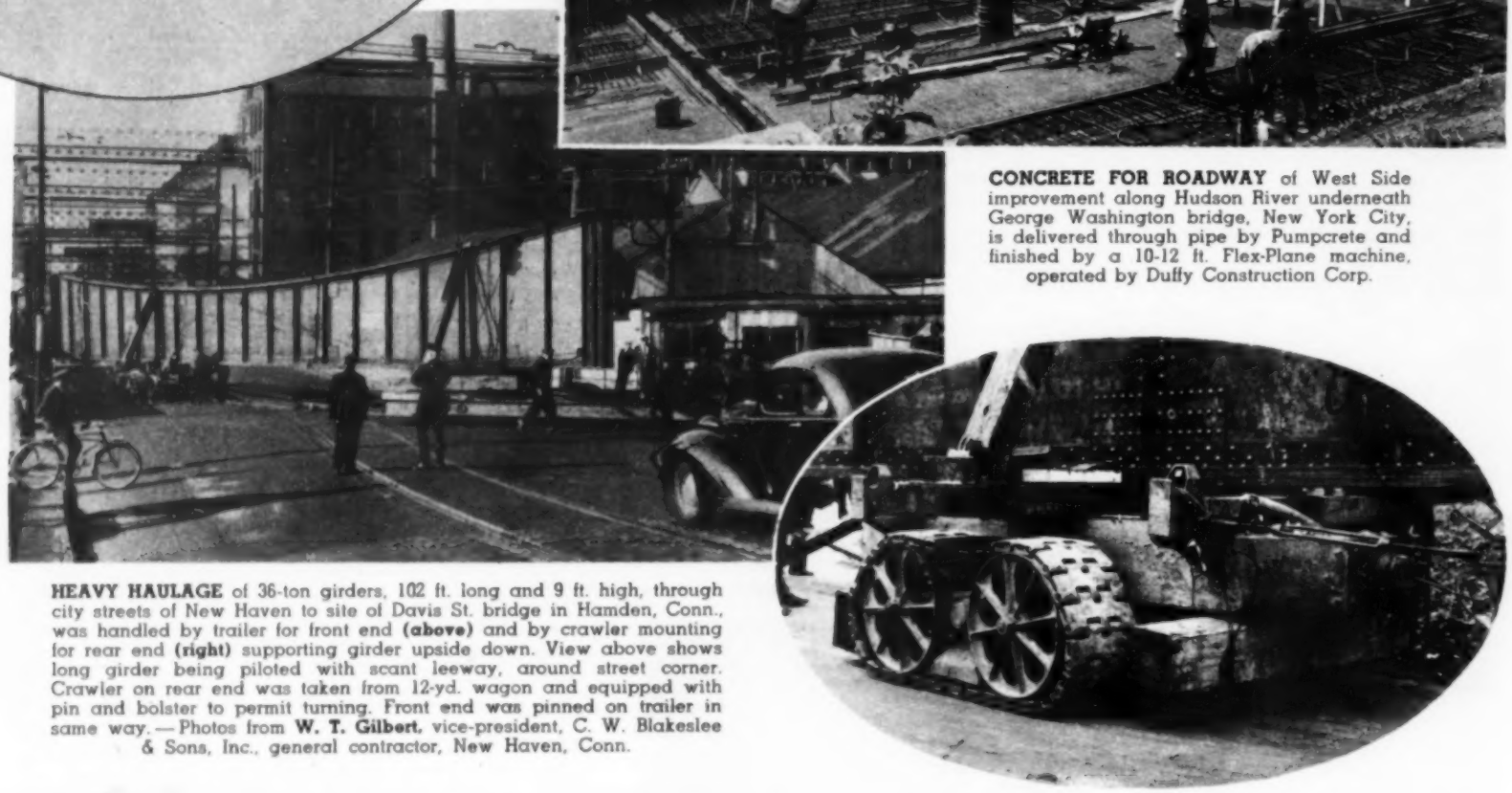
LIGHTER MEMBERS (below) at top of arch are cut at flat angle and welded so that flanges match.

How They Did It —

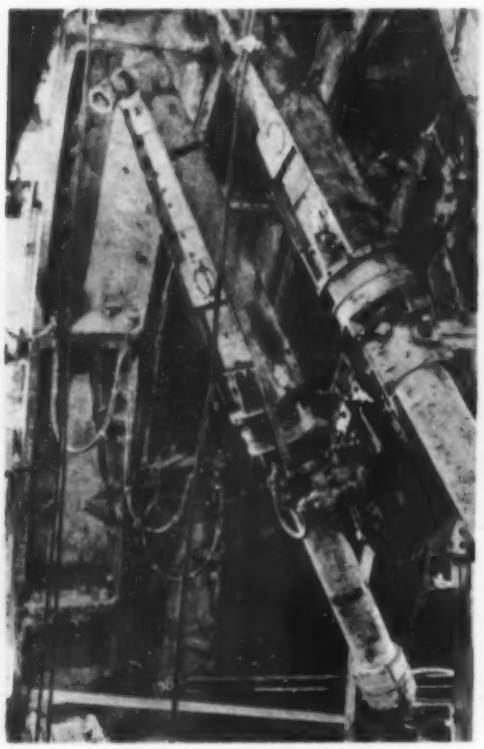
CONSTRUCTION DETAILS

For Superintendents and Foremen

CONCRETE FOR ROADWAY of West Side improvement along Hudson River underneath George Washington bridge, New York City, is delivered through pipe by Pumpcrete and finished by a 10-12 ft. Flex-Plane machine, operated by Duffy Construction Corp.



HEAVY HAULAGE of 36-ton girders, 102 ft. long and 9 ft. high, through city streets of New Haven to site of Davis St. bridge in Hamden, Conn., was handled by trailer for front end **(above)** and by crawler mounting for rear end **(right)** supporting girder upside down. View above shows long girder being piloted with scant leeway, around street corner. Crawler on rear end was taken from 12-yd. wagon and equipped with pin and bolster to permit turning. Front end was pinned on trailer in same way. — Photos from **W. T. Gilbert**, vice-president, C. W. Blakeslee & Sons, Inc., general contractor, New Haven, Conn.



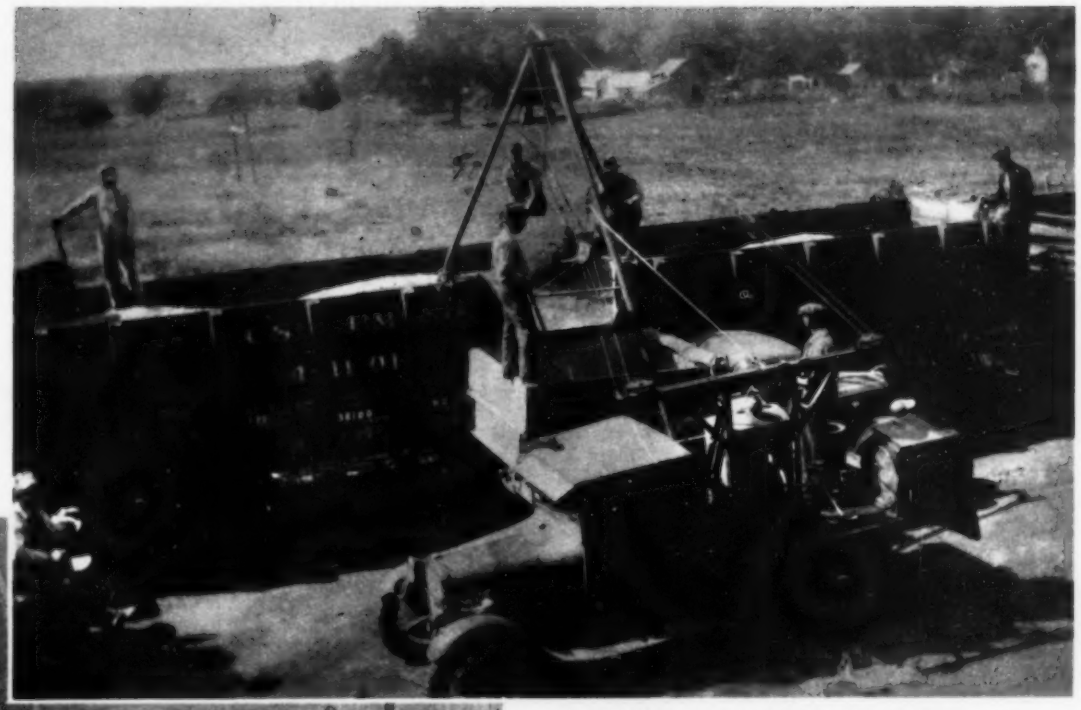
BOLTING MACHINE (left) hydraulically operated by forces of Mason & Hanger Co., Inc., of New York City, connects cast-iron segments of lining in 31-ft. diameter subaqueous tube of Lincoln Tunnel between New York and New Jersey. Rapid progress in advancing tunnel shield through river silt was due, in large measure, to increased speed of bolting up lining rings with specially designed machine, instead of by hand wrenches.

DITCHER pulled by Caterpillar diesel tractor cuts trench 30" in. deep in clay at Timaru municipal airport in New Zealand. Material thrown clear of trench is picked up and removed by 12-yd. Le Tourneau carryall scraper

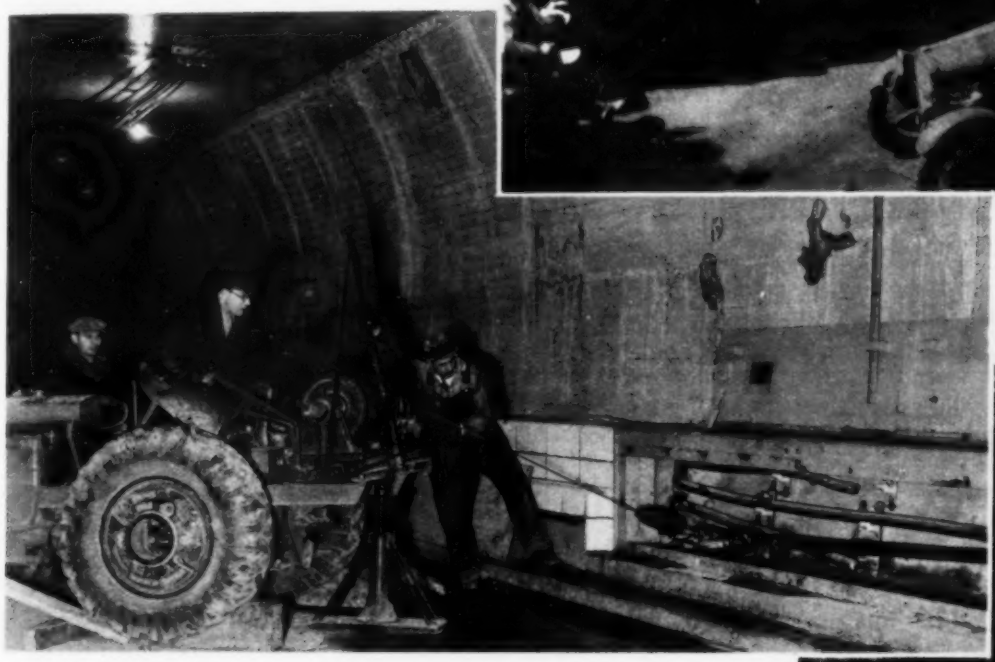
WANTED —
Photos of Details

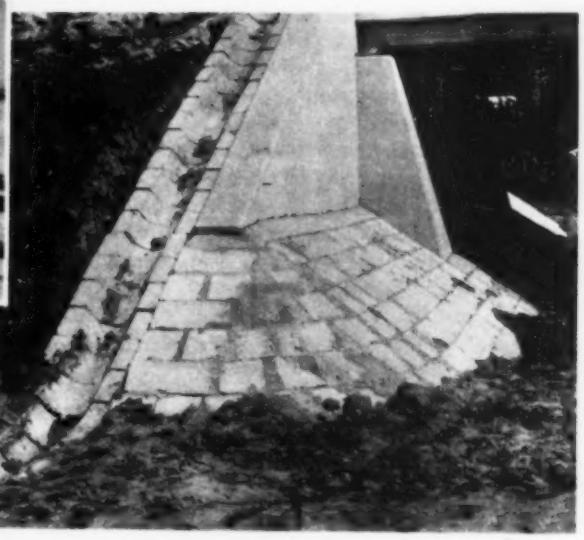
The Editor of Construction Methods wants photographs or sketches illustrating interesting **DETAILS** of method or equipment and will pay for those he finds acceptable for publication.

Hasn't your job produced some **DETAIL** that might be illustrated on this page? Send along a picture of it; we'll return it promptly if we can't use it.



UNLOADING of crushed stone from railway cars into trucks for delivery to road-building job in Missouri is done with simple rig consisting of A-frame and slip-scraper, operated by hoist powered by engine on truck.





PULLING ELECTRIC CABLE (right) through ducts below sidewalk of newly completed south tube of Lincoln vehicular tunnel under Hudson River, New York City, is done by winch on rear end of Allis-Chalmers tractor. Sheave carries cable to winch drum on rear of tractor which is jacked up to prevent movement.

HYDRAULIC RAM at rear of truck raises quarry skip clear of ground and transports broken rock to crushing plant where it is reduced to surfacing material for Blue Ridge Parkway, Section 2A1 (North Carolina), Nello L. Teer, Durham, N. C., contractor.

SUBSTITUTE (above) for stone revetment and cobblestone gutter at bridge abutment commonly specified in Missouri. Gutter blocks are made of a lean concrete mix, grouted after placement. They readily conform to fill settlement, making maintenance by regrouting a simple matter. — Photo from **D. O. Wolfe,** of Sverdrup & Parcel, consulting engineers, St. Louis.

CALKERS (right) seal with oakum and pitch seams in huge 54-ft. square gates used to close diversion channels in Grand Coulee dam, through which river has been flowing. — Photo from U. S. Bureau of Reclamation.

Planning and Plant for

TWENTY-FIFTH OF A SERIES OF ARTICLES

HEAVY CONSTRUCTION

Principles and Practices of Job Layout and Selection and Use of Equipment

By ADOLPH J. ACKERMAN and CHARLES H. LOCHER
Construction Engineer *Construction Consultant*

• 25 •
Electric Power and Equipment

IN RECENT YEARS the use of electricity on large construction projects has developed to such an extent that many large jobs are now considered completely electrified; steam, diesel or gasoline prime movers are used only for secondary or isolated services. Consequently, the electrical engineering of a construction plant is of great importance. Adequate advance planning and attention to detail are required to develop the most economical power and distribution system, and to assure maximum reliability and freedom from interruption at any point in the electrical system.

The great variety and sometimes intermittent operation of construction equipment introduces severe electrical disturbances, such as high peaks of short duration, unavoidable surges and short circuits. Therefore, the incoming transmission line, the substation and the plant distribution system should be designed with liberal capacity and with special consideration to ruggedness, simplicity, and adequate electrical protective features even though the entire system may be considered as a temporary facility.

Distribution System

A good example of a carefully planned electrical system is the one designed by T. S. Whitehouse for the Hiwassee dam which is here described.

The power lines from the low tension side of the main transformers are connected to the plant distribution switchboard, consisting of ten 2,300-volt panels. Panel No. 1 is a 2,000-amp. transformer incoming panel. The other nine panels are 600-amp. feeder panels for nine separate circuits leading to various points of the construction and camp area so that interruptions in any one circuit are isolated and do not ordinarily affect operations in the rest of the area.

Each circuit is provided with protective equipment and watt-hour meters. The incoming panel No. 1 is equipped with the following:

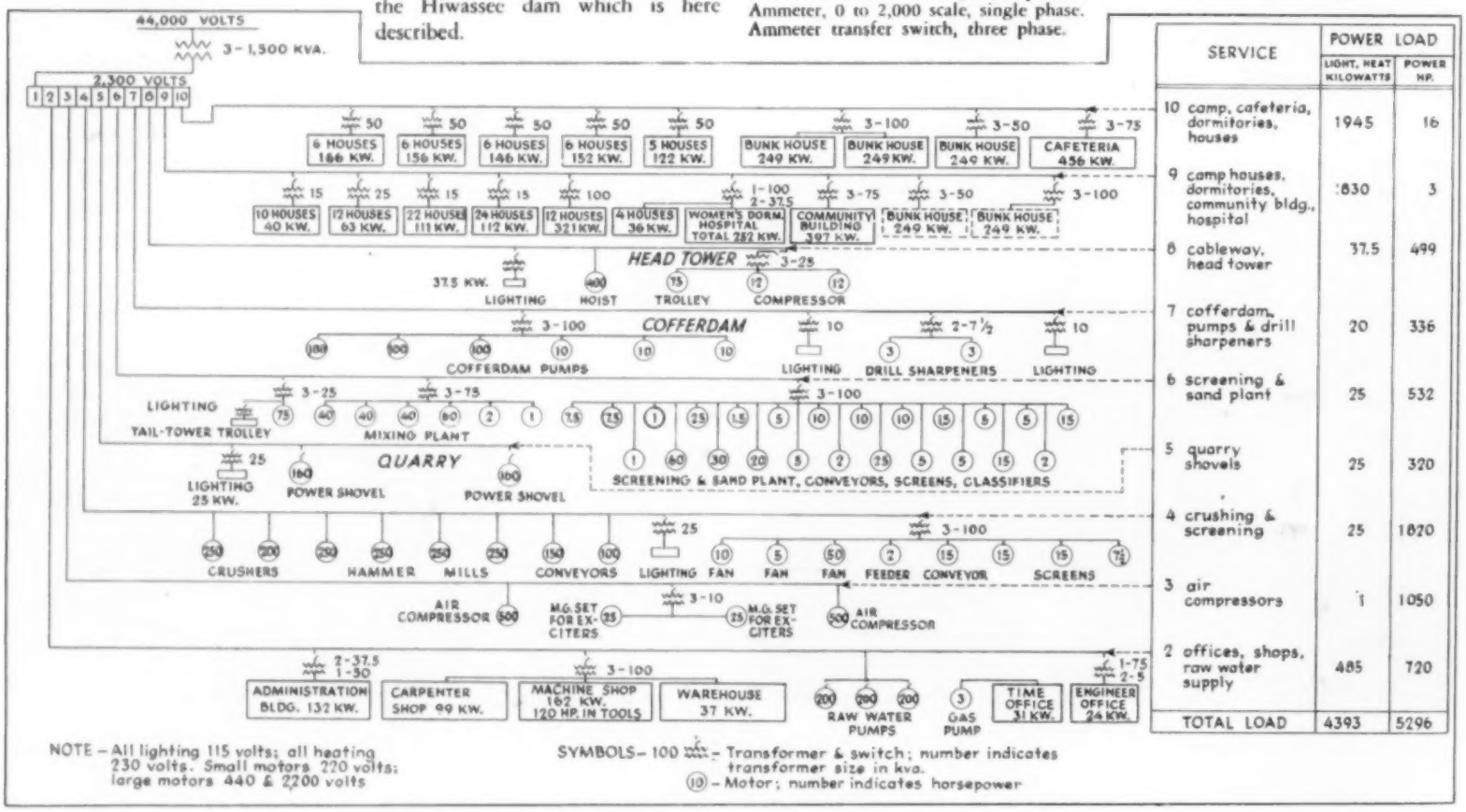
Manual 2,000-amp. oil circuit breaker.
Three disconnecting switches, 7,500 volts.
Volt meters, single-phase with scale reading 0 to 3,000.
Voltmeter transfer switch, three phase.
Ammeter, 0 to 2,000 scale, single phase.
Ammeter transfer switch, three phase.
Power factor indicator, 0.5-1 — 0.5 scale, three-phase.
Recording watt-meter, 0 to 1,000 watt scale.
Recording watt-meter transfer switch.
Watt hour meter, three phase.
Test block.
Potential transformers for metering.
Current transformers for metering and o.c.b. tripping.

The graphic recording watt-meter is so arranged that it can be plugged into any one circuit for studying power requirements and plant efficiency. Portable recording watt-meters are used to supplement these studies on individual equipment.

Each feeder panel contains the following:

Manual 600-amp. oil circuit breaker.
Three disconnecting switches, 7,500 volts.
Ammeters, 0 to 600, single phase.
Ammeter transfer switch, three-phase.
Recording watt-meter transfer switch.
Watt-hour meter.
Potential transformers for metering.
Current transformers for metering and o.c.b. tripping.

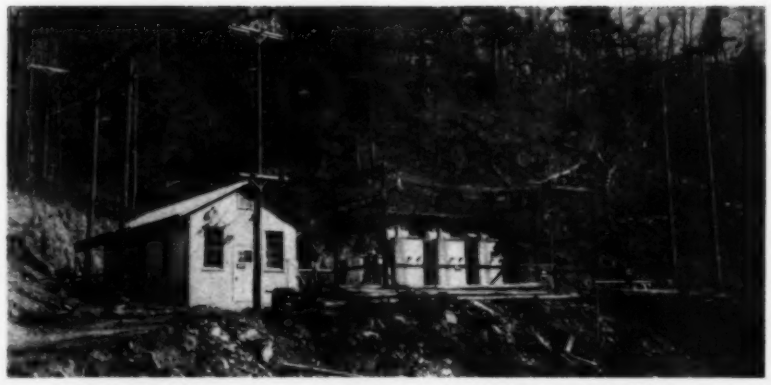
The construction plant distribution circuits are laid out for maximum flexibility since many items of equipment, such as electric shovels, pumps, drills, welders, etc., must be shifted to new positions on short notice. Practically all motors above 50 hp. are 2,200 volts, with a few exceptions such as cofferdam pumps; smaller motors, except built-in and portable tool motors, are operated from 440-volt lines. Most of the motors driving shop equipment, located in various construction plant buildings are rated for operation from 220-volt supply. It is especially important to keep the voltage on cofferdam pumps down to prevent accidents to men who are sometimes obliged to handle



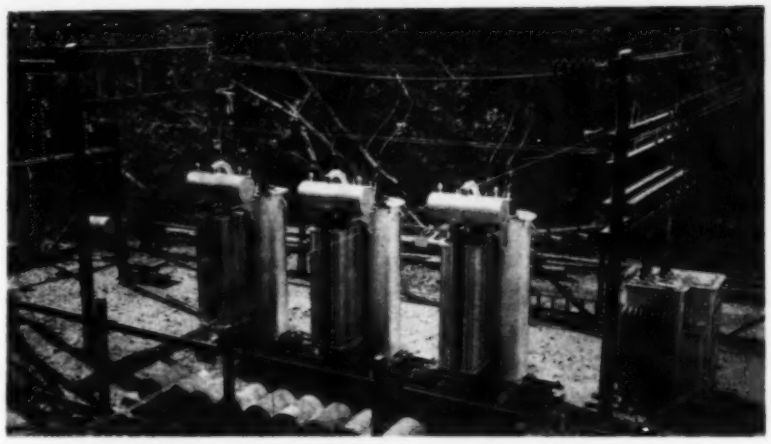
SERVICE	POWER LOAD	
	LIGHT, HEAT KILOWATTS	POWER HP.
10 camp, cafeteria, dormitories, houses	1945	16
9 camp houses, dormitories, community bldg., hospital	830	3
8 cableway, head tower	37.5	499
7 cofferdam, pumps & drill sharpeners	20	336
6 screening & sand plant	25	532
5 quarry shovels	25	320
4 crushing & screening	25	1820
3 air compressors	1	1050
2 offices, shops, raw water supply	485	720
TOTAL LOAD	4393	5296

ELEMENTARY one-line wiring diagram of load requirements for Hiwassee dam.

SIMPLE TYPE of transmission line poles for carrying high-voltage power to construction project.



STEP-DOWN substation at Hiwassee dam, with switch-house and2300-volt distribution lines to work areas shown at extreme left.



STEP-DOWN transformers and voltage regulator at Hiwassee dam.

SECONDARY distribution transformers for stepping 2300-volt power down to 440-220 volts at load points.

them in emergencies without shutting off the power.

Distribution transformers are located on the borders of the main work area to prevent interference with hauling equipment and to keep them out of danger from blasting. The transformer banks are generally kept down to capacities of 300 to 500 kva. to facilitate moving on short notice. It is highly desirable to keep the number of different sizes of transformers at a minimum to simplify interchanging and shifting, even at the expense of occasional low efficiency operation.

Construction camp circuits, when fed from the same substation as the power circuits, should always be isolated from circuits supplying power to plant equipment and it is desirable that they be protected by reclosing type circuit breakers.

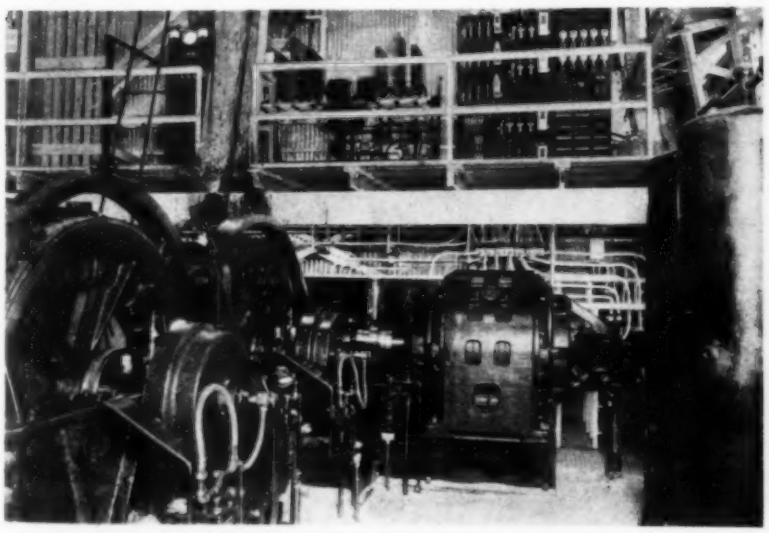
One of the accompanying tables gives the load requirements for Hiwassee dam. As a further indication of loads on such projects, the following is taken from Norris dam, where the total connected load was 6,500 kva. The maximum registered peak was 4,100 kva., while the annual average peak was 3,540 kva. The annual consumption was 15,738,000 kw.-hr. The total connected load at the town of Norris was 6,500 kva. The maximum registered peak was 2,524 kva., while the average annual peak was 1,704 kva. The annual consumption was 4,854,000 kw.-hr. Both of the above loads were fed from one 2,500-kva. and one 1,500-kva., three-phase transformer.

Selection of Motors

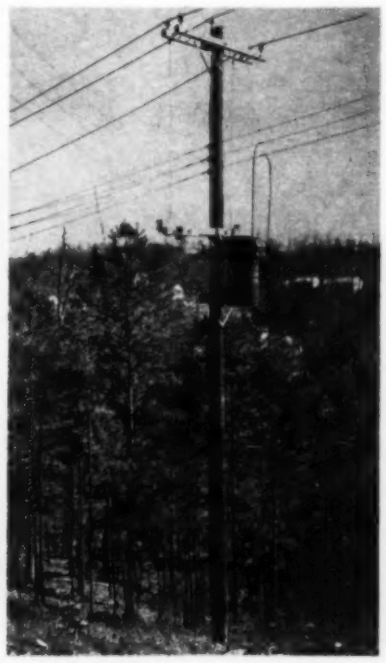
The selection of motors for a construction project involves consideration of the required load characteristics such as operating torques, constant or variable speed, reversing or non-reversing, continuous or intermittent duty. Each motor should be interchangeable with other similar equipment, and its control should be simple and free from unnecessary automatic features. The accompanying table gives the representative types of motors and their general application to various types of construction equipment.

Alternating current motors are available in single-phase or poly-phase types. Poly-phase motors, classified generally as induction or synchronous, are most commonly applied for construction work while the single phase motors have relatively few applications except for small tools, fans, vibrators and other equipment requiring low power. Induction motors are of two types, squirrel cage and wound rotor. The squirrel cage motor is best adapted for all classes of constant speed service where starting infrequent and moderate starting and running torques are required. The wound rotor motor, on the other hand, is used for frequent starting duty and provides high or moderate starting torque with low input current. By using collector rings and external rotor resistance, this type of motor is readily adapted to various types of service requiring variable speed control over a wide range, as on hoists and similar equipment.

The synchronous motor, operating at a constant synchronous speed, is available generally in two types, one providing unity power factor and the other 80 per cent leading power factor. Because of its value for power factor correction the 80 per cent leading power factor type is of great advantage in constructing electrical systems to help counterbalance the effect from a large number of low power factor induction motors; power factor correction often leads to obtaining a better price for power from the power company. Because pure synchronous motors have no starting ability, they are frequently supplied with special added windings which make them start as induction machines. Synchronous motors with separate motor-driven exciters and reduced voltage starting equipment are generally used to drive air compressors. Similar motors with across-the-



ELECTRIC MOTOR (400 HP) and 2300-volt control panels, with resistors for heavy duty cableway at Norris dam. Motor is of the wound rotor induction type.

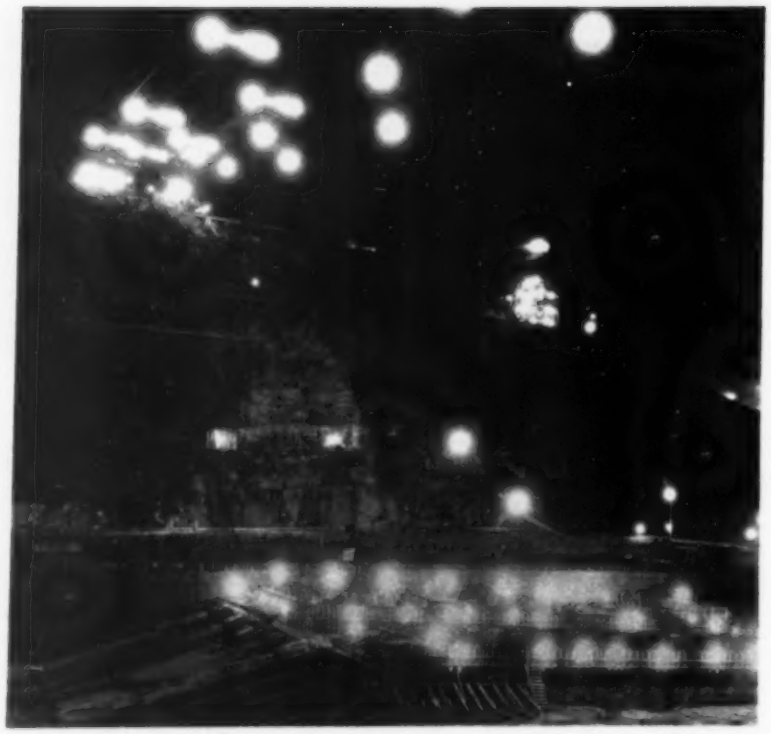


SECONDARY transformers for 220-110-volt camp home service.

line starters and direct connected exciters usually drive the generators in motor-generator sets.

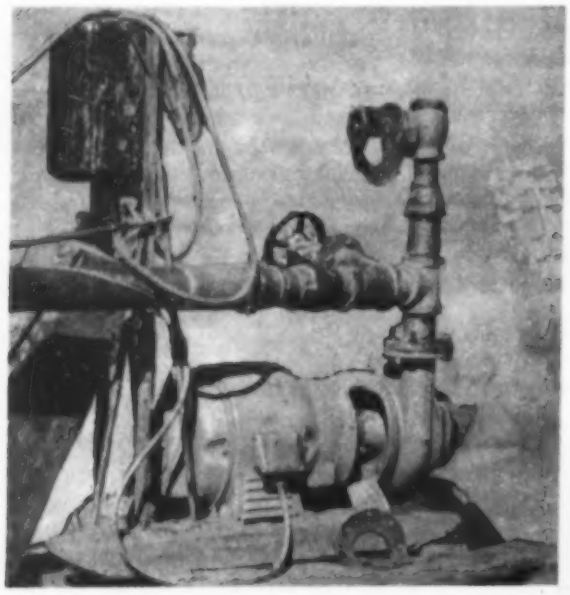
From a standpoint of speed ratings the following types of motors are available: constant speed; adjustable speed; varying speed (with load changes); adjustable varying speed; and multi-speed. Furthermore, motors are classified by their external features in mechanical construction as follows: open, drip-proof, protected (semi-inclosed), semi-protected, splash-proof, separately ventilated, self-ventilated, totally inclosed, totally inclosed-fan cooled, explosion proof and submersible; and their internal features through special insulation as follows: fume-resisting, submersible, temperature-resisting, moisture-resisting, acid-resisting, and abrasive and conducting dust-resisting.

Direct-current motors are not used as commonly on construction work because most power systems furnish alternating current, and in shifting from one project to another the investment in direct current equipment would be uneconomical. However, direct-current motors have very desirable characteristics, particularly for construction service, and sometimes find special applications. Direct-current motors come in series, shunt and compound-wound types. The series motor is used where a high starting torque and rapid acceleration are required, as on street cars and similar services. The speed rises as the load drops. In shunt-wound motors the speed is practically constant at various load conditions, but the starting torque is lower. In the compound-wound motor of the cumulative type, the characteristics of the series and shunt motors are combined to give a high starting torque with a speed which does not vary greatly with load. The following characteristics are representative of d.c. motors, the figures being in terms of per cent of full load conditions. The d.c. shunt motor has a starting torque of 180 per cent, a starting current of 170 per cent, and a maximum pull out torque of 225 per cent. The d.c. compound-wound motor has a starting torque of 200 per cent, a starting current of 170 per cent, and a maximum pull out torque of 300 per cent.

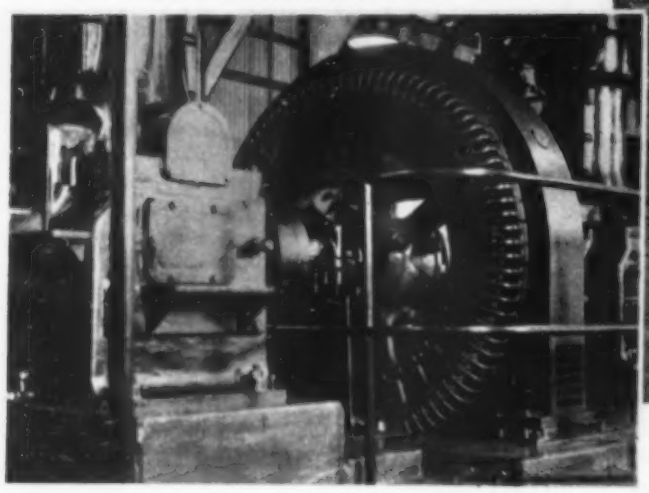


CONSTRUCTION LIGHTING at Norris dam. Local lighting circuits were used around forms where concrete is being placed. General overhead lights suspended from cableways are effective for general lighting as shown in foreground.

OPERATOR'S CONTROLS for cableway, showing switches for drum frictions and brakes, and reversing, variable speed type of controllers. This system of remote control permits placing the operator where he can see all operations.



SMALL PORTABLE electric pump and starting box with waterproof power cable.



SYNCHRONOUS TYPE motor **(left)** used on air compressor. This type helps to raise the power factor of the construction load.

HEAVY-DUTY 2,300-volt waterproof power cable carrying current to electric shovels.

Starting and Control Equipment

The control equipment for the various types of motors deserves special analysis so that standardization can be practiced as far as possible, thereby allowing the various operators who handle the equipment to develop a familiarity all along the line.

Because of its simplicity, across-the-line starting is generally used in construction work on motors up to 100 hp., although 50 hp. is the desirable limit. Under certain loading conditions reduced voltage starting may be necessary. Above 50 hp., wound rotor motors, with equipment to control acceleration or speed, are commonly employed. Certain applications require special control equipment which must be designed to agree with the duty cycle of the driven equipment; this requires a

3-Phase Motor Applications for Construction Work

SQUIRREL CAGE INDUCTION MOTORS

N.E.M.A. Class.	Characteristics	Horse Power Range M'frs St'd	General Characteristics in Per Cent of Full Load: Starting Torque	Starting Current	Breakdown Torque	Speed Reg. % Slip	Starting & Control Equipment	Load Condition	Typical Equipment Applications	
A	Normal Torque Normal Starting Current	5 hp. and smaller	125 to 250%	450 to 600%	200 to 225%	3 to 5%	Across-the-line starting. Where excessive current peaks are objectionable use reduced voltage starting.	Constant speed. Continuous duty. Practically constant torque requirements. Starting torques should be within values given.	Fans Tool and Metal grinders	Pumps Joiners Circular Saws
		7½ hp. to 200 hp.	125 to 150%	500 to 700%	200 to 225%	2 to 5%	Reduced Voltage starting		Motor-generator sets Screw-machines Planers	Shapers Blowers
B	Normal Torque Low Starting Current	7½ hp. to 200 hp.	125 to 150%	400 to 500%; 40 hp. and above, — 500 to 600%	200 to 225%	3 to 6%	Across-the-line starting	Same as above, except low starting current is a necessity.	Pumps (Cent.) Milling Machines Lathes Buffers	Drill presses Bar bender
C	High Torque Low Starting Current	3 hp. to 200 hp.	200 to 250%	400 to 475%; 40 hp. and above, — 500 to 600%	275 to 225%	3 to 6%	Across-the-line starting for small motors, or unloaded conditions. For larger sizes use reduced voltage starting.	Same as above, except where applied load requires higher values of torque.	Conveyors Crushers Bolt Mills Hammer Mills Vibrating Screens Car Pullers	Bucket-type Elevators Concrete Mixer Air-Compressor Pumps (Recip.) Grinders
D	High Torque High Slip	2 hp. to 50 hp	200 to 300%	300 to 400%	200%	10 to 20%	Across-the-line starting, or Primary resistance control, with master switch.	High starting torque requirement, intermittent duty. When used with primary resistance control, provides controlled speed and acceleration.	Propelling equipment for gantry cranes Elevators Lifts Hoists Small Cranes	

WOUND ROTOR INDUCTION MOTORS

Characteristics	Horse Power Range M'frs St'd	General Characteristics in Per Cent of Full Load: Starting Torque	Starting Current	Breakdown Torque	Control Equipment	Load Condition	Typical Equipment Applications	
Constant Speed	1 hp. to 200 hp.	160 to 240%	Determined by required torque for starting and control resistor classification	200 to 300%	Primary starting switch with secondary rheostat; or drum switch and resistors for starting duty only.	Continuous duty High starting torque Controlled starting current Controlled acceleration of load a requirement	Conveyors Air Compressors In general, all applications as given for squirrel cage motors, where controlled acceleration is a necessity.	
Adjustable Varying Speed	1 hp. to 200 hp.	160 to 240%	Same as above	200 to 300%	Same as above, except resistors rated for variable speed duty.	Same as above, except speed adjustable in steps.	Rock Drills Rock Crushers Concrete Mixers Dredge Machinery	Blowers Fans
Adjustable Varying Speed Regenerative Braking Service	3 hp. to 200 hp. & to 500 hp. and up	160 to 275%	Same as above	200 to 350% Special up to 400%	Same as above, for variable speed duty, intermittent rating.	Same as above, for adjustable speed, except intermittent duty.	Hoists Cranes, Whirler Shovels Derricks, Hoist & Swing Cableways	

SYNCHRONOUS MOTORS

Characteristics	Horse Power Range M'frs St'd	General Characteristics in Per Cent of Full Load: Starting Torque	Pull-In Torque	Pull-Out Torque	Control Equipment	Load Condition	Typical Equipment Applications	
80% Leading Power Factor, mainly for power factor correction use. Constant speed. Poor Starting Torque	20 hp. to 5,000 hp.	40 to 200%	40 to 200%	140 to 400%	Across-the-line, reduced voltage, or part winding, starting. Control equipment usually specially designed for each particular application incorporating the required protective and control features. Requires separate excitation.	Continuous duty. Constant synchronous speed. Constant or fluctuating torque. Operates with high efficiency.	Air Compressors Ball Mills Crushers Hammer Mills Pumps Ideal for compressor drives and all conditions of constant speed-load service.	Blowers Fans Line Shafts

special study of the load conditions.

The combination fusible magnetic switch of the weatherproof type, with protective equipment, offers the advantage of low installation cost for induction motors in construction work.

The control equipment for either squirrel-cage or wound rotor motors may be of the manual, semi-magnetic or full magnetic type. The latter two offer the advantage of push button control, whereby the speed control of a wound rotor motor during acceleration can be made entirely automatic. Manual control on a large motor is obtained by using a drum controller or master switch with resistors.

The Ward-Leonard system of electric drive and control is used on special construction machinery such as hoisting units, cranes or shovels, where the desirable characteristics of d.c. equipment offer a substantial improvement in efficiency of operation. On an a.c. job system the power is first delivered through a motor generator set having multiple generators which generate direct current, and each one drives one of the hoist motors. Speed control of the hoist motor is obtained by varying the field current in the generator and this offers a simplification of control, doing away with a large amount of auxiliary control equipment with its attendant possibilities for interruption.

Interlocks and Signal Systems

A matter of great importance on construction work is the use of interlocks for certain operations such as conveyors feeding from one to another and into screens and crushers so that if failure should occur at any point the system feeding to that point is automatically stopped, thus preventing unnecessary piling up of material. At Hiwassee dam, where a long series of operations is interdependent in the screening and crushing system, the control equipment has been designed so that the equipment must be started at the plant output end. In other words, the last motor is started first and in this manner the entire plant is successively brought into operation. Furthermore, the interlock wiring is so arranged that if any motor is stopped, either purposely by an emergency stop button, or by electrical or mechanical failure, all equipment supplying material to the point of failure will automatically stop and all equipment beyond the point of failure will continue to empty itself. Under this system, the point of failure is automatically indicated and permits making prompt repairs without searching over the entire system for the electrical or mechanical defect.

The use of signal lights, bells, horns and similar devices plays an important part in keeping the various inter-related features of a plant in proper function. Throughout the crushing, screening and sand plant at Hiwassee Dam, central control stations are provided for the benefit of operators in controlling sectionalized groups of motors. Various signal lights mounted on panels in front of the operators show, in their "on" condition, that motors in other sections are running satisfactorily.

To cut down dust in screening plants ventilating fans must be started before crushing equipment is placed in operation. At Hiwassee this has been so arranged that in case the crusher or any other dust producing equipment is started before the ventilating fans, a horn will blow; also, should the fan stop accidentally the horn will blow.

Lighting

The work area lighting is almost entirely of a temporary nature, since it must move with the concrete-placing operations which may be at extreme ends of the dam within 24 hr. A simple but effective type of lighting is therefore essential. For yard lighting and for construction roads sodium-vapor lights are finding favor; they produce a yellow light without glare, have fog penetrating qualities, and are low in power consumption.

✥

NEXT MONTH — Chapter 26, the final installment in the series on "Heavy Construction" by A. J. Ackerman and C. H. Locher, to appear in the March issue will deal with "Human Relations in Construction."

Who's Who at Grand Coulee Dam

SAM MASON
Treasurer, Mason-Walsh-Atkinson-Kier Co.

J. D. CANNING
Purchasing Agent

DON O. NELSON
Structural Engineer

C. D. RIDDLE
Chief Engineer

FOLLOWING the recent completion of the first construction stage of Grand Coulee dam on the Columbia River in Washington, involving 20,000,000 cu.yd. of excavation at the site and the placement of more than 4,000,000 cu.yd. of concrete in the 177 ft. high base of the structure, bids were received Dec. 10, 1937, for "topping out" the dam to its ultimate height of 553 ft. above the lowest point of the foundation. Under a $29,339,300 contract awarded by the U. S. Bureau of Reclamation July 16, 1934, the Mason-Walsh-Atkinson-Kier Co. completed its work of building the base or "low dam." Herewith are pictured some of the superintendents and other field men of the M.-W.-A.-K. organization who helped put the job through well ahead of schedule.

A group of contracting company executives who submitted the low bid of $34,442,240 for completing the top half of Grand Coulee dam, is shown in the "News Reel" section on a preceding page of this issue.

RUSS BROWN
Rigging Superintendent

K. L. PARKER
Reinforcing Steel Superintendent

J. E. (BLACKIE) ARMSTRONG
Rock Superintendent

DAVE ANDERSON
Power-House Superintendent

JIM SMALL
Concrete Superintendent

JAMES DOYLE
Superintendent, M.-W.-A.-K. railroad

FRANK SMITH
Excavation Superintendent

E. R. STOKES
Carpenter Superintendent

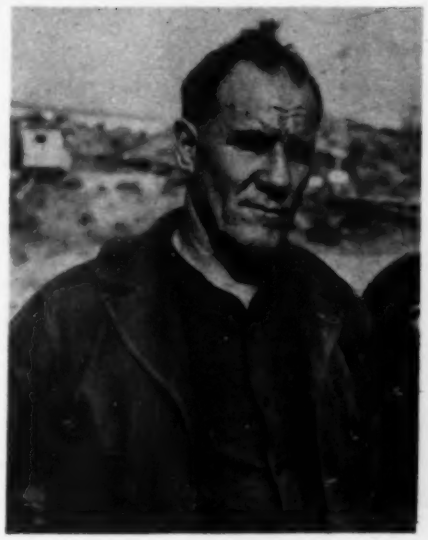
KIRBY JONES
Field Engineer

JIM DEVINE
Master Mechanic

HARVEY W. SLOCUM
General Superintendent

JACK BROTON
Form Stripping Foreman

JACK MEEHAN
Drill Sharpening Foreman



GUY SMITH
Chief Electrician

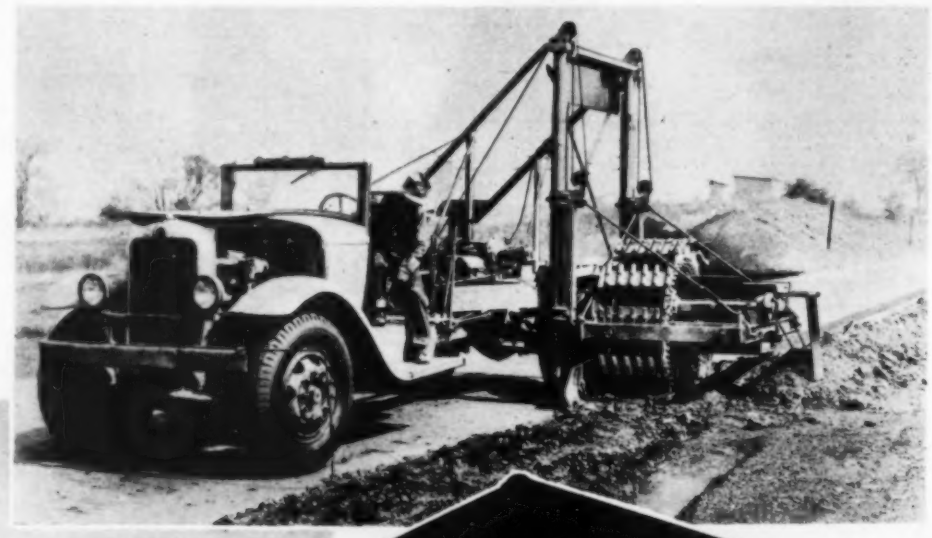
JOHN TACKE
Concrete Clean-up Foreman

J. EARL MYERS
In Charge of Warehouse, Lumber Yard and Transportation

CONSTRUCTION EQUIPMENT NEWS

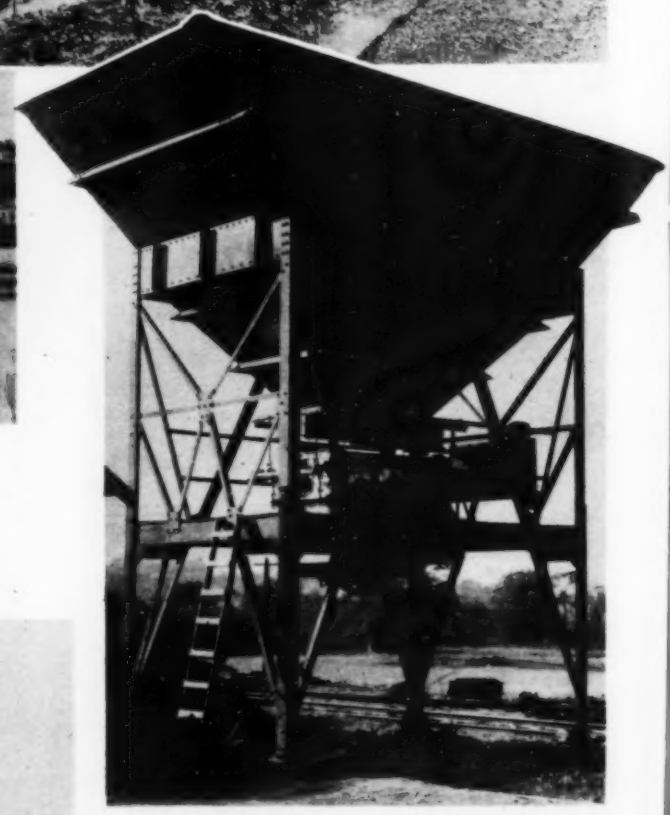
(ALL RIGHTS RESERVED)

Review of Construction Machinery and Materials for FEBRUARY 1938



HIGHWAY WIDENING MACHINE (right) developed to meet need for equipment which can be used effectively for excavating alongside of pavement already laid. Will dig trench from 12 to 48 in. wide at one cut, working right up to curb or edge of existing pavement and leaving clean, evenly graded subgrade ready for foundation of new pavement. If pavement is to be extended to greater width than cut which can be made at one time by machine, it is easy to go back over job for second or third cut. — **Buckeye Traction Ditcher Co., Mansfield, Ohio.**

15-YD. ALL-STEEL PNEUMATIC-TIRED BUGGY for use on rock jobs, long hauls, in transporting ore or gravel, or in work with shovels and draglines on levee jobs where material is too hard for scraper loading. In unloading, body moves backwards over bed pushing load through ever-widening opening at rear so that wheels do not travel over material. This opening, extended, measures 7 ft. 10 in. by 9 ft. 10 in., facilitating unloading of boulders. Four 18x24-in. pneumatic tires and Timken roller bearings provide light-draft hauling unit. Struck measure capacity, 11.84 cu.yd.; heaped measure, 15 cu.yd. Weight, 14,500 lb. Cable controlled by single-drum power-control unit or by double-drum unit when used in tandem. — **R. G. Le Tourneau, Inc. Peoria, Ill.**

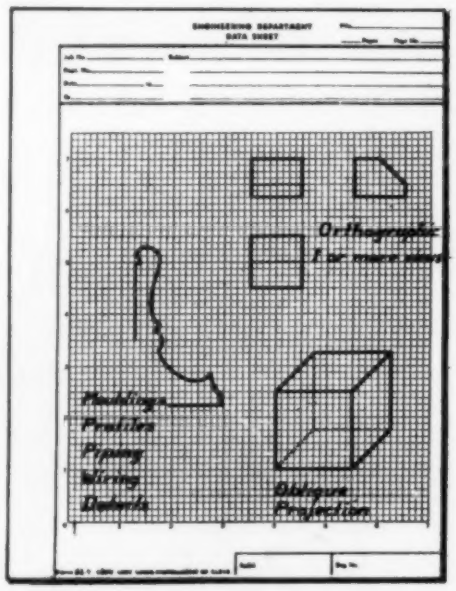


PORTABLE BATCHING PLANT (above), designed for use as truck-mixer as well as contractor's unit, has one-piece main section built within railroad clearances and capable of supporting live load of 100 tons. Batcher charging gates and platform supports in place when unit is shipped and four pedestal legs are easily attached. Extension, fabricated in four large sections plus partition plates, is bolted together on ground and raised to position in one piece. May be equipped with batch-truck or truck-mixer type batchers of 1½- and 2-yd. capacities. When truck-mixer batcher is furnished, pedestal legs may be extended, difference in height being taken up by increasing height of concrete piers, if desired. Two- or three-compartment bins are self-cleaning with minimum hopper slopes of 50 deg. Ample clearance for trucks and charging bucket. — **Heltzel Steel Form & Iron Co., Warren, Ohio.**

NEW SHOVEL BOOM (right) for 1½- and 1¼-yd. Lorain shovels combines two booms in one — structural member to absorb all bending and compression stresses and torsional member to absorb and resist all boom twisting stresses. Each member connected independently to shipper shaft, and boom hinges in such a manner that no torsional stresses can pass through structural member and no bending stresses through torsion member. All boom twists and torsional stresses absorbed by separate torsional member consisting of 11-in.-diameter seamless tube extending from shipper shaft to boom hinges. Dipper sticks used with these booms are also 11-in.-diameter seamless tubes. In new boom shipper shaft is placed further ahead to give greater reaches and is located in lower position to permit dipper stick to assume more vertical angle for higher digging and dumping ranges. — **Thew Shovel Co., Lorain, Ohio.**

LEATHER WELDING GLOVES are made of specially tanned horsehide leather combined with cowhide, which assure longer wearing and greater comfort to users. Pliable — will not stiffen upon drying after immersion in hot or cold water. Longer palms and shorter cuffs. — **The Linde Air Products Co., 205 E. 42nd St., New York City**

SKETCH SHEETS for all types of sketches, operations and estimates, have 7x7½-in. drawing area laid out in ⅛-in. squares with inch lines heavy and numbered on 8½x11-in. sheet. Printed on 100 per cent rag tracing poper which will not deteriorate



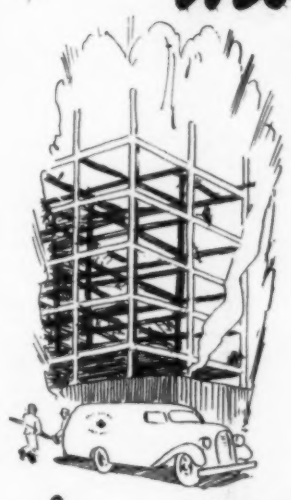
and can be used for permanent records. Also available with 7x10-in. sketching area without other printing. Black ink and pencil drawings stand out clearly on this paper assuring clear blueprints.— **Wade Instrument Co., 2246 Brooklyn Station, Cleveland, Ohio.**

LIGHT-DUTY TRUCKS constructed to handle loads too heavy for average truck of this type are available in ¾-, 1- and 1¼-ton capacities. All three models are powered by new "223" engine and have

newly designed rear axles, big rear springs, new frames, three-speed syncro-mesh transmission, husky spring pins and U-type shackles. Three body types available for these models: panel, pick-up and platform stake. Both 1- and 1¼-ton models have load space for 9-ft. bodies. — **General Motors Truck & Coach Division, Detroit, Mich.**

WHEELED ROLLER originated and developed by Wheeled Roller Corp., of San Antonio, Tex., and described in March, 1937, issue of **CONSTRUCTION Methods and Equipment**, is now manufactured and sold by Littleford Bros., 465 E. Pearl St., Cincinnati, Ohio. Improvements in mechanical design of unit have been made by this company and these will appear in new 1938 models.

Assure CONTINUOUS PRODUCTION *by making the job* SAFE



● "Poor Joe. A great guy and a good structural steel man. He knew how to put a jog together well . . . and in a hurry. But he was too sure of himself!"

Sooner or later, you're going to face a similar situation!

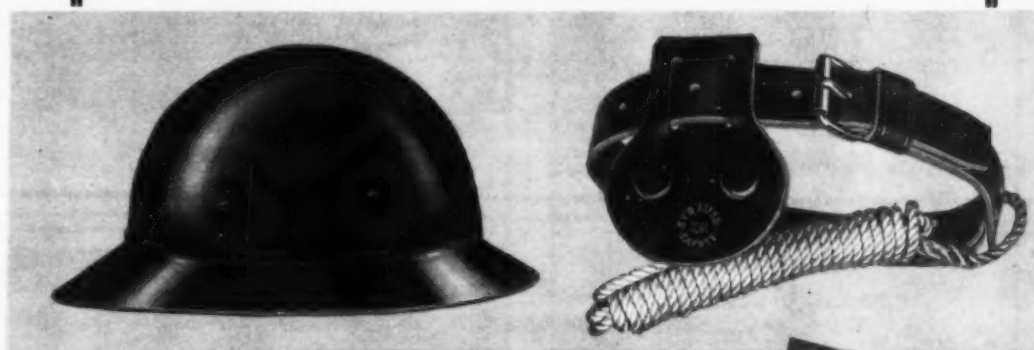
A slip on structural steel or wet masonry . . . a missed rivet, red hot and hard . . . any one of a hundred mishaps may cost you a reliable key man, temporarily or even permanently. Long expensive delays follow . . . the confidence of your men is destroyed. And yet, a very small investment would provide him with safe, dependable head protection and a safety belt.

THE "HEAD PROTECTOR" HELMET

Made of "National" Vulcanized Fibre, moulded into a seamless hat of great strength and unusual light weight. Tests prove that it withstands the impact of an eight pound ball dropped eight feet. Well ventilated and extremely comfortable.

"STRAUSS" SAFETY BELTS

No. 4X-R-12 is used by thousands of structural steel workers and bridgemen throughout the United States. Made of finest oak tanned steerhide. A 12-foot rope is spliced into the loop, which is reinforced with rawhide to prevent cutting.



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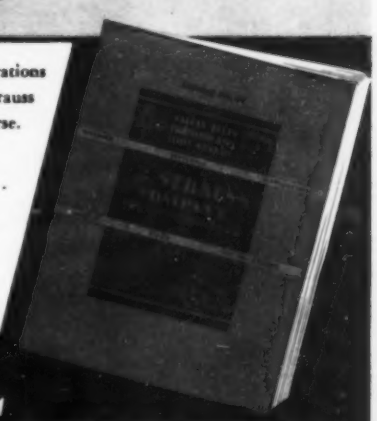

The STRAUSS *Company*

Designers and Manufacturers of Safety Belts, Protective Hats and Foot Guards . . . for Use Above, Below or On the Ground.

PITTSBURGH - - - - - PENNSYLVANIA

Even the man on the flying trapeze could use a Martin-Decker Tension Indicator to advantage, for it gives quickly and accurately the *actual* load on a line without calculations and without dead-ending.

Moreover, it catches those sudden surging, impact loads that do so much damage but are practically impossible to calculate. Simply clamp it to the line (no wrenches needed) and read the dial. It's as simple as that . . . and as fool-proof!

WE SHOULD HAVE CHECKED THOSE ROPES WITH A MARTIN-DECKER TENSION INDICATOR!

Available in Three Sizes

Miniature for lines and cables up to 5/16", capacity 200 lbs.

Standard for wires or cables from 1/4" to 5/8", capacity 15,000 lbs.

Heavy Duty for wires or cables from 5/8" to 2 3/4", capacity 250,000 lbs.

All sizes are adjustable for temperature. Write for complete dope on this instrument, and also on the Martin-Decker Traveling Line Weight Indicator.

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LONG BEACH CALIFORNIA
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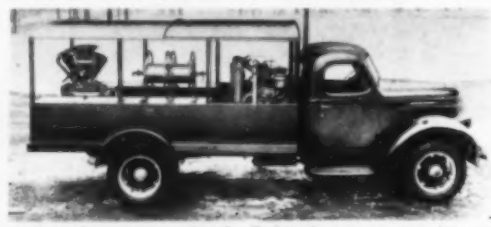
If this attracts your attention stop and think of the other readers who will also stop and read it. If a product of yours were substituted and your name and address were added this space would be something that your salesmen could capitalize. There are hundreds and hundreds of signatures in *Construction Methods & Equipment* files that prove unquestionably that these advertising pages receive a lot of attention.

• • •

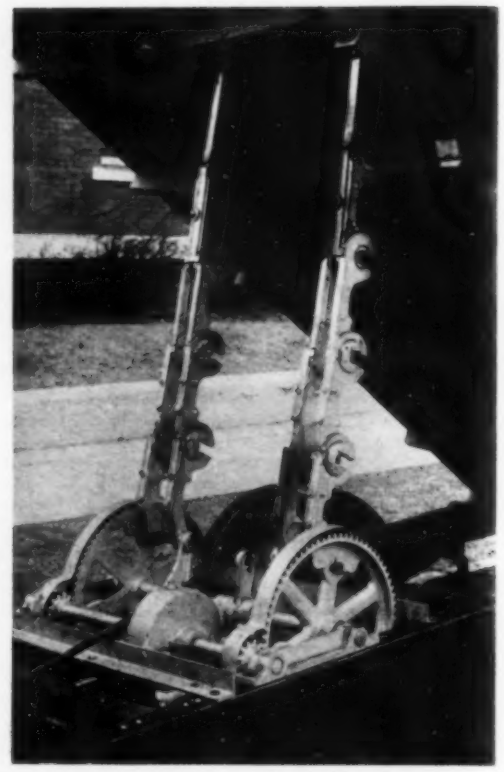
CONSTRUCTION EQUIPMENT NEWS... *Continued*

EXCAVATOR TIRE built for use in most destructive types of tire operations such as rock quarrying, logging, excavation in rocky soils, coal stripping and other heavy-duty services. Tread and sidewalls are made of specially tough cut resisting rubber preventing snags from injuring chord body. Shoulders are higher better to distribute load and wider to protect sidewalls. May be purchased in range of sizes used on vehicles in types of service for which tires were built.—**Firestone Tire and Rubber Co., Akron, Ohio.**

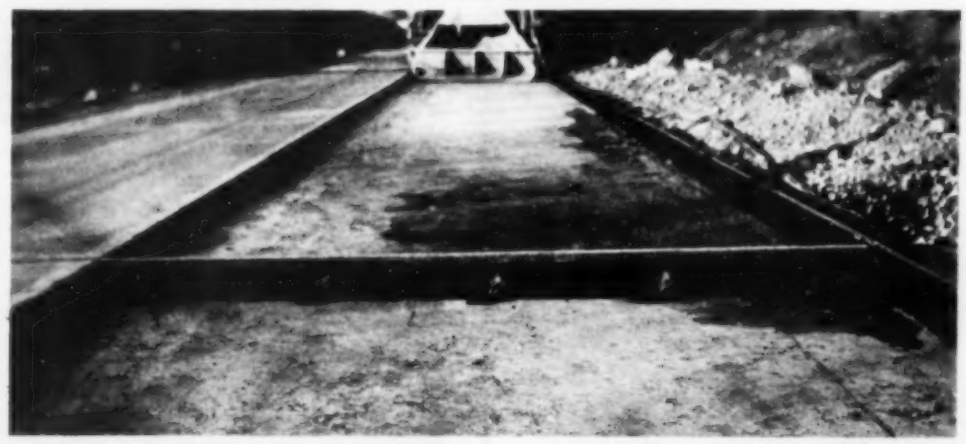
MOBILE PNEUMATIC CONCRETE PLACER called "Crete-Mobile" is complete truck-mounted, truck motor operated unit installed on standard model 1½ ton capacity chassis. Consists of 105-cu.ft. two-stage air compressor driven directly from truck motor by Hercules split-shaft power take-off and mount-



ed directly at rear of cab. Behind compressor is suspended water tank. Mixing tank and cement motor are placed at rear of truck chassis. Air hose extends from air receiver tank to air motor which forces sand and cement through hose. At nozzle of hose water under 40-lb. pressure enters completely hydrating cement and sand. Mixture is then shot from nozzle to point desired. Concrete 1½ in. thick and covering 10 sq.ft. per hour can be placed with this machine. Unit is as portable as motor truck can make it. Opens new fields for concrete placing, such as repairing highways, building bridges, culverts, sidewalks, curbs, gutters, swimming pools, tunnels, storage tanks, and furnaces, and for water-proofing brick, wood and concrete block buildings and reconditioning unsightly structures.—**Hercules Steel Products Co., Galion, Ohio.**



LIGHTWEIGHT TRUCK BODY HOIST makes truck an all-purpose unit for every type of hauling because when hoist is not in use truck bed is as securely locked in place as though it were bolted to frame with U-bolts. Lifting action of hoist accomplished by segmented jacks which lock into rigid struts or tension members and are unwrapped, section by section, from triplex pin spiders. Power of jacks same in tension or compression, and they automatically lock body in any position. Thus, unit can be used, not only to elevate body and load, but also as hoisting mechanism in loading heavy tractors. Lifting pressure applied close to front end of body in all positions, reducing to minimum distorting forces applied to body.—**Kyle Sales Co., P. O. Box 212, Decatur, Ill.**

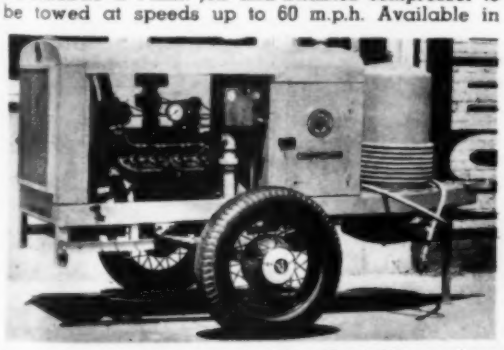


EXPANSION JOINT FILLER, non-mushrooming type, consists of Celotex board, called Flexcell, fibers of which have been completely impregnated and coated with durable protective asphalt. Cell structure of board is still preserved providing resilient cushion capable of re-expanding after being released from compression by external pressure. Air cells within felted board perform like a bellows—always ready to absorb compression; wiry cane fibers spring board back to shape when it is released from compression. Advantages: Can be cut and handled at all temperatures; will properly compress and expand with movement of slab; will not extrude and require trimming. Recommended for use in sidewalks and driveways, service stations, concrete tennis courts, glass block wall construction, loading platforms, stadiums, floors, swimming pools, airport runways, bridges, curbs, and machine cushioning. Flexcell Co. is manufacturer.—**Celotex Corp., Chicago, Ill., distributor.**

STEEL CABLE CUTTER designed to cut cable up to 1½-in. size with minimum of effort. Particularly adapted for use with steel band, thin sheet of pliable, but tough steel indented with groove and lock seam at one edge in lengths and sizes to fit cables. This band is applied to rope before cutting and eliminates risk of injury to hands from jagged wire ends. Using this cutter, any grade or size of cable up to 1½ in. may be seized or whipped and cut by one man, using an 88-lb sledge, in less than one minute and both ends of cut cable will be incased in steel band ready for passing through any fitting or fixture. Peculiarly shaped cutting blade and die prevent flattening of cable in process of cutting and rope retains natural shape and lay of strands. Three models: light kit, capacity up to ¾ in.; heavy-duty portable, up to 1 1/16 in.; extra heavy-duty portable, up to 1½ in. cable. **—Montgomery & Co., Inc., 282 Lafayette St., New York City.**

STREAMLINED CONCRETE MIXER incorporates faster charging and discharging, lighter and stronger frame, accurate water control and increased engine power. Faster charging made possible by use of shimmy skip which discharges batch into drum with free, fast-sliding action. Discharging through extra large opening on to streamlined chute, drum is completely cleaned in 7 sec. Water system with vertical measuring tank and non-by-pass free-way valve allows no water to dribble into drum. Mounted on rigid steel frame and supported from axles by coil steel springs at each wheel. Automotive-type steering. Furnished in four-wheel end or side discharge models with pneumatic, solid rubber or steel tires. Powered by 25-hp., radiator cooled, gasoline engine. Batchmeter and centrifugal water pump, optional equipment. — **Chain Belt Co., Milwaukee.**

LIGHT-WEIGHT PORTABLE COMPRESSOR for all types of construction work where pneumatic tools are used and where portability is an asset. "Quick-way" snap-on towing hitch makes attachment to automobile a 1-min. job and enables compressor to be towed at speeds up to 60 m.p.h. Available in two sizes, 7 and 140 cu.ft. Two Ford V-8 engines used in construction of larger model. One V-type engine is used on smaller unit with one bank of V used for power cylinders and other bank for air cylinders with W-K air head attached. Other special features: economical operation; parts available at local service stations; "double-cooled" air valves; electric starter; 6-V plug-in lights; spring mounting; pneumatic tires, and large roomy tool box.—**W-K Mfg. Co., 231 Southwest Blvd., Kansas City, Mo.**



JACKSON BACKFILL TAMPER

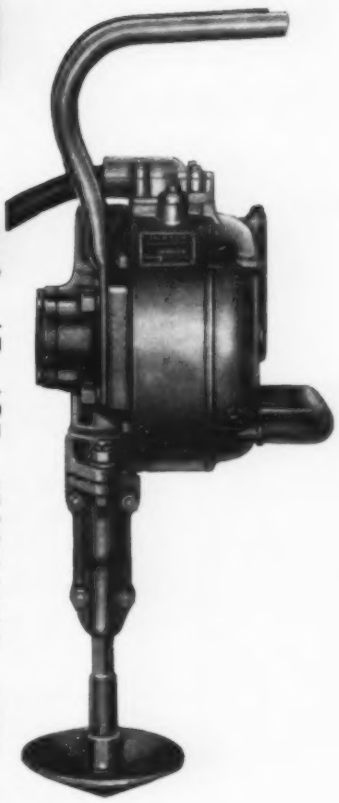
For all backfilling and earth tamping operations where a fast and portable machine is required.

A rugged, easily handled, and economical electric tool, striking 1500 to 1800 direct and very powerful blows a minute.

Conical or flat tamping discs, 6", 8" and 10" diameter, may be ordered for each machine for use in earth of varying density and cohesion. In most soils, conical tamping discs are preferred because the area of compaction secured with them is much greater than can be obtained with flat tamping feet.

The Jackson Backfill Tamper compacts thicker layers firmly, bonding them into a uniformly consolidated mass to entirely eliminate smooth planes between layers.

Economically operated by a Jackson Portable Power Plant, which can be used for lighting and to operate a Jackson Concrete Vibrator.



1-H. P. input. 110-volt, 3-phase induction motor.

ELECTRIC TAMPER & EQUIPMENT CO.
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You've got more important things to do than changing dies to thread 1", 1¼", 1½" and 2" pipe. And this RIDGID No. 65R saves you the trouble—all pipe, all threads.

For in this remarkable tool, the same set of dies threads all 4 sizes perfectly. Simply move setting post to size you want. No extra dies to lug around, to worry about losing.

Slick work-holder, too—sets quickly to pipe size, tightens with one screw.

A strong, beautifully balanced tool pleasing thousands by its fast clean work. Try it—you like the "feel" of it at once. Buy from your Jobber.

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PIPE RIDGID TOOLS

"Established 1885"

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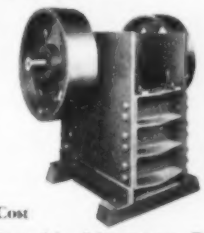
Road Building —Equipment—

"One Reduction" Roller Bearing Jaw Crushers



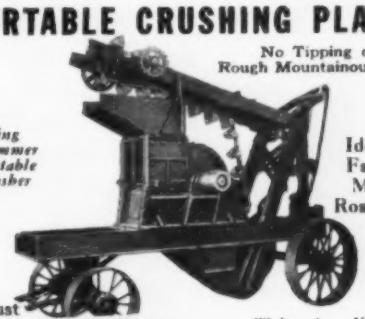
Saves 10% to 15% in Fuel
90% in Lubrication
More Production at Lower Cost

Mfrs. of Stationary or Portable Limestone Pulverizers, Gravel and Rock Crushing and Screening Plants, Conveying and Screening Equipment.

PORTABLE CRUSHING PLANTS

No Tipping on Rough Mountainous Roads

Swing Hammer Portable Crusher



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Adjustable Crushing Range from 2½" down to Agricultural Dust.

Write for Illustrated Bulletins of our Lifetime Hammer Mill and Jaw Crushers.

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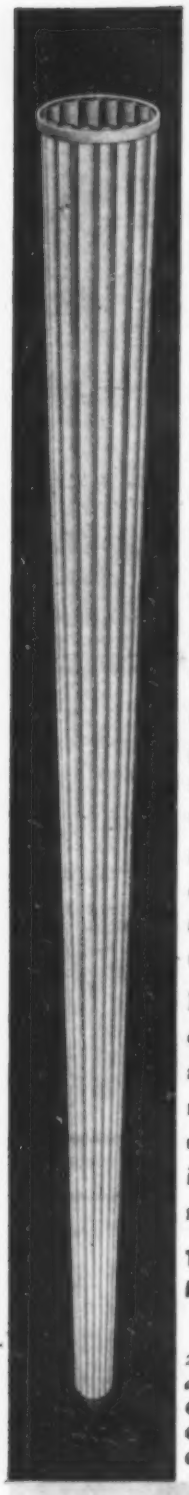
You Drive No Useless Weight with

UNION METAL
fluted steel
PILE SHELLS



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With all their strength, Union Metal Pile Shells are extremely light in weight. This means important economies in both the amount and type of equipment used. No special unloading rigs are necessary and any crane equipped with standard leads and light hammer can handle the driving.

Put Union Metal Shells to the test on your next job. You will find, as have hundreds of other engineers and contractors, that they enable you to install better cast-in-place concrete piles for less money. Write today for catalog.

THE UNION METAL MANUFACTURING CO.
Canton, Ohio

215 Union Metal Pile Shells were driven for this grade elimination at Crittenden, N.Y. Engineers—New York Central R.R. Contractors—Cold Springs Contracting Co., Akron, N.Y.

NEWS FROM MANUFACTURERS
About Their Products

The publications reviewed below, will keep you posted on latest developments in construction equipment and materials available for your use.

NICKEL ALLOY STEELS FOR HAND TOOLS — **The International Nickel Co., Inc.,** 67 Wall St., New York City. (16 pp. illustrated). Use of alloy steels for hand tools and small power tools is indicated wherever high strength and toughness combined with light weight, improved wear and fatigue resistance, high impact strength or better ductility are demanded. They are widely used for making such tools as wrenches, hammers, chisels, screwdrivers, wood working tools, pliers, rivet sets, saws, knives and lifting jacks.

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101 USES FOR WROUGHT IRON — **A. M. Byers Co.,** Pittsburgh, Pa. (32 pp. illustrated). More than 100 photographs, each illustrating a different use for wrought iron, some representing new construction, some showing maintenance replacements and others depicting use in a finished product to increase its salability. Some uses of wrought iron illustrated: Floor plates on railroad bridge; sewer outfall line out to sea; bands on fermenting tanks; conduit in lighting system; flag poles; hand railings and blast plates on viaduct; roofing, siding and ventilators on transit shed; siding sheets used as replacements on pier.

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ROLLER GATE CONCRETE BUCKETS — **Blaw-Knox Co.,** Pittsburgh, Pa. (16 pp. illustrated). Contains details and illustrations of various kinds of roller gate buckets including cableway operating types, underwater types, and special designs for unusual requirements. Complete list of specifications and sizes included.

● ● ●

PLYWOOD — **United States Plywood Co., Inc.** (40 pp. illustrated). Describes and illustrates uses of this product and methods of manufacture. Supplies instructions for application and proper erection of Douglas Fir and California Pine Plywoods and also gives detailed account of origin and uses of Flexwood, a genuine wood veneer for interior decoration; of Micarta, a modern material for interiors and exteriors and Armorply, a metal-faced Plywood.

● ● ●

ASBESTOS-CEMENT PIPE — **Johns-Manville,** 22 E. 40th St., New York City (32 pp., illustrated). Illustrated book on manufacture and use of "Transite Pressure Pipe." Tells story from time pipe first was developed 25 years ago up to present day. Describes manufacture and tests made before release for shipment. Ways in which use of Transite pipe is said to lower installation, operating and maintenance costs are explained. Data on cost of pumping water are given. Considerable information on methods of installing pipe, assembly of Simplex couplings used for jointing and making of service connections. Copies available on request to manufacturer.

● ● ●

FOUR-WAY FLOOR PLATE — **Inland Steel Co.,** 38 S. Dearborn St., Chicago, Ill. (16 pp., illustrated). Uses and advantages of steel flooring patterned with four-way projections which grip foot or wheel firmly and prevent accidents common on smooth surfaces. Partial list of uses includes floors and galleries in factories, power houses, and public buildings; working spaces around machinery; steps and vestibules on railroad cars; steps and walkways on trucks; operating decks of excavators and similar equipment; stairways in factories; office and public buildings; sidewalk hatchways; loading platforms; bridge treads; dam walkways; wherever safe footing and sure traction are required. Available in light and standard patterns and wide range of thicknesses. Tables showing sizes, thicknesses and weights of plates.

COPPER AND BRASS IN HOME CONSTRUCTION — **Revere Copper & Brass, Inc.,** 230 Park Ave., New York City. (32 pp. illustrated). "The House You Live In" is a profusely illustrated booklet showing the various uses of copper and brass in house construction. Gives comprehensive explanation of numerous roof types, how they should be built and where they should be protected from weather. Takes up subjects of flashing, water supply system, water tanks, heating and air conditioning. Lists additional copper and brass home safeguards: bronze windows, copper radiation, plain or hammered copper hoods for fireplaces and built-in window boxes for year-around use.

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SAFETY APPAREL — **Industrial Gloves Co.,** 745 Garfield Blvd., Danville, Ill. (20 pp., loose-leaf, illustrated). Describes and illustrates widely used hand and body guards for prevention of injuries. Lists more than 3,000 individually designed types of gloves, mittens, hand leathers, arm protectors, sleeves, aprons, chaps, leggings, shin guards, spats, coats, pants and fire fighting suits from chrome leather, asbestos and fireproofed duck materials.

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WATER WELL DRILLS — **Bucyrus-Erie Co.,** South Milwaukee, Wis. (24 pp. illustrated.) Contains descriptions and field action and shop photographs showing machinery, derricks, controls and other important parts of well drilling machinery. Complete story of all working parts, special advantages and outstanding features.

● ● ●

CERTIFIED STEELS — **Joseph T. Ryerson & Son, Inc.,** Dept. P., Box 8000-A, Chicago, Ill. (28 pp. illustrated.) Explains in detail how Ryerson Certified Steels solve problem of obtaining uniform and quality controlled steel for immediate shipment from stock — includes specifications, suggestions to heat treaters, etc. Of value to all users of steel and especially to those interested in alloys.

● ● ●

"HOW TO BUY CULVERTS" — **United States Steel Corp., Subsidiaries,** 434 Fifth Ave., Pittsburgh, Pa. (24 pp. illustrated). Reference data for highway, railroad, airport and other construction engineers. Describes small round, part circle and perforated culverts. Includes useful tables on recommended gages, acres drained by culverts of various diameters, capacities of corrugated culverts when flowing full and safe velocities of flow in various soils. Method of determining culvert sizes by Talbot Equation is described and illustrated by typical example. Another table is an aid to calculating discharge of corrugated culverts by means of Burkli-Ziegler formula.

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CHAIN AND CABLE PRODUCTS — **American Chain and Cable Co.,** Bridgeport, Conn. 12-pp. convenient reference booklet giving comprehensive index of more than 200 Acco products; shows breakdown of plant divisions and products, lists sales offices and warehouses for speedy handling of orders.

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WIRE ROPE'S NATURAL ENEMIES—**American Chain & Cable Co.,** Inc., Wilkes-Barre, Pa. (28 pp. pocket-size, illustrated.) Constructive treatise on many things that wear out rope and how either to avoid them or minimize their effect. Sheaves, reverse bends, kinking, whipping, abrasion and many other "enemies" of wire rope are discussed in simple, non-technical language. Four-page supplement deals with actual money-value to keeping of accurate records of wire rope service and carries several "service record" forms which rope user can utilize in keeping track of machine production and rope service.

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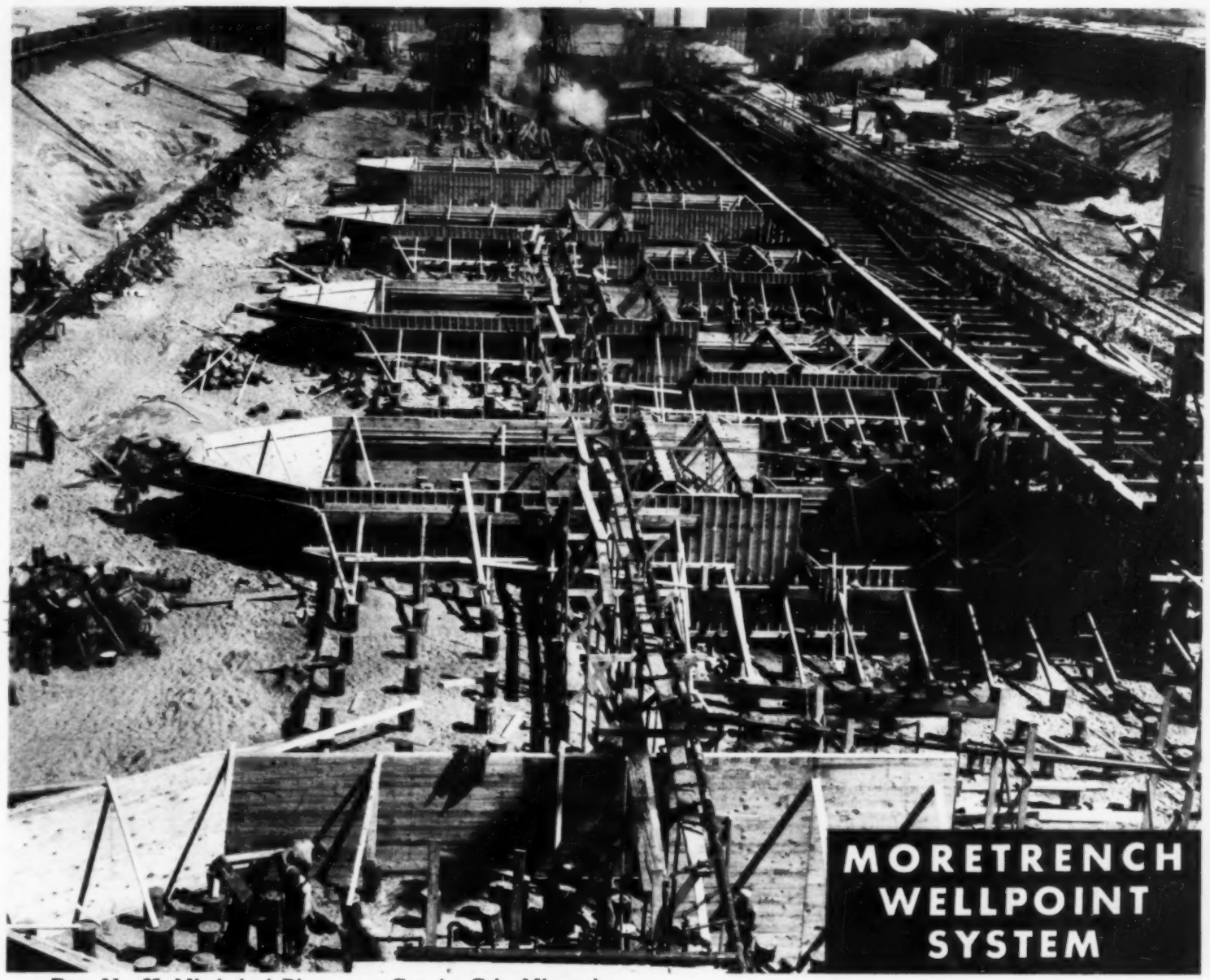
DIESEL TRACTORS — **Allis-Chalmers Mfg. Co.,** Milwaukee, Wis. (40 pp., illustrated). Describes Model "LO" oil tractors used by contractors, highway departments and loggers. Views of machines in action, of various cross-sections and of features of construction such as controlled alignment, track construction, controlled ignition and unit construction are shown. Controlled ignition diesel fuel burning engine is described in concise manner and advantages over high compression-ignition type engines are explained.



Dam No. 25, Mississippi River, near Cap Au Gris, Missouri

The late Chauncey Depew said:

"IT TAKES COURAGE TO ESTABLISH A SCRAP PILE."

DAM No. 25 is the sixth Mississippi Lock or Dam Job to be completed by the United Construction Co. of Winona, Minnesota. On the fifth operation they installed a few Moretrench Wellpoints to get some inside information. On the *sixth*, Moretrench blossomed out all over the lot — ONE HUNDRED PER CENT. Thirty thousand gallons of water are being pumped back — non-stop — into the Mississippi every minute of the day to keep this subgrade dry.

"THE USE OF YOUR EQUIPMENT HAS AFFORDED US THE BEST FOUNDATION CONDITIONS WE HAVE ENCOUNTERED" — so United writes. The Moretrench Wellpoint System is used all over the world to dewater wet excavation. We rent, we sell, or we take the pumping work off your hands at a fixed price. We have the plant, the men, and the know how.

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Sales and Rental Office:
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Profits . . .

depend on knowing *how to buy* as well as *how to sell*

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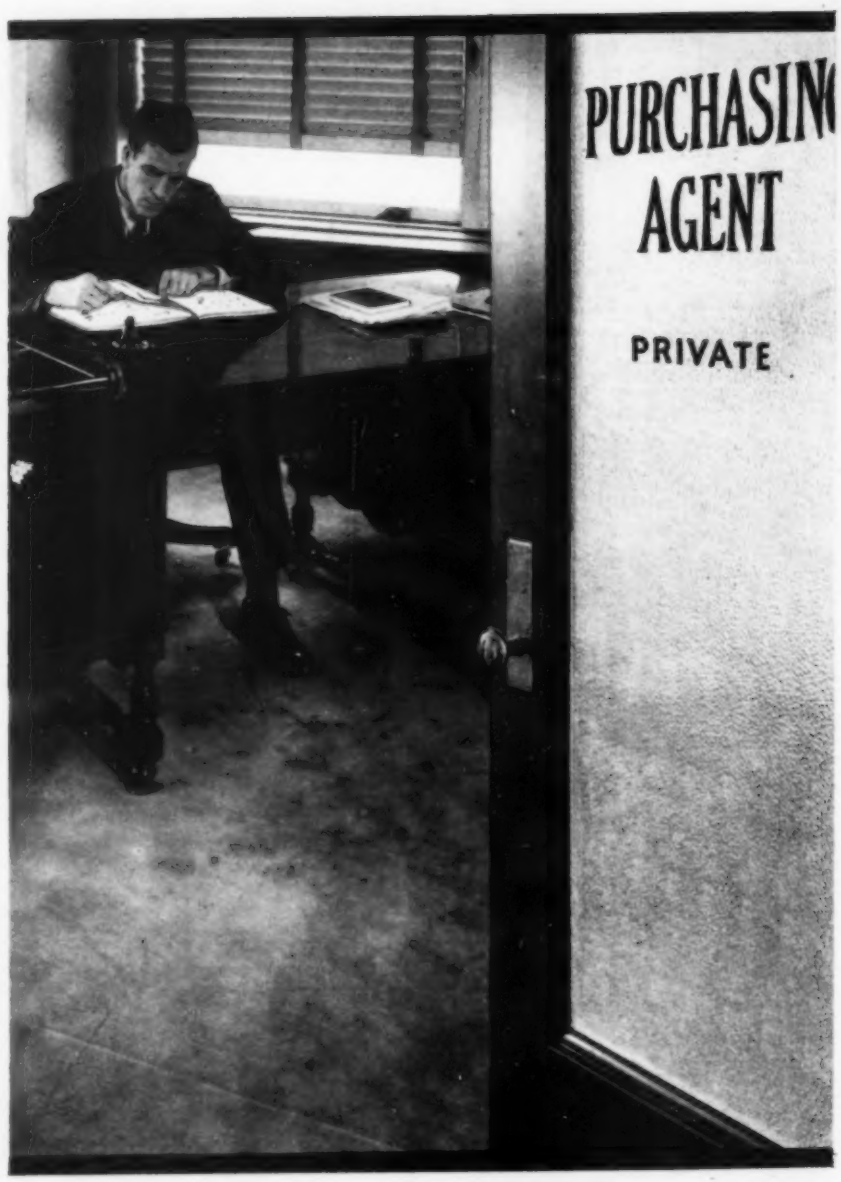

THAT'S why in every sizable company, you'll find a "Purchasing Agent"—a company buying expert, who finds, from sales interviews and studies, just where and how to buy everything his company needs and how much to pay for it.

The Purchasing Agent is always ready to be shown how your product can help stretch his company's dollar. More than that, he welcomes and expects your help in telling that story to his management executives. It's unfair to expect him to spend his time explaining an unadvertised, unknown product to them. It's part of your job to educate these executives through consistent business paper advertising, so that their good-will plus the P.A.'s reasons-to-buy will make the O.K. a routine matter.

Your modern Purchasing Agent wants you to do this job through advertising, because it sells his management executives, yet allows him to protect them from time-consuming "cold turkey" calls and "missionary work." You'll want to do it *through advertising in the McGraw-Hill Publications*, because it costs ever so much less that way.

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AT ANY SANE SPEED

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AMERICA'S LEADING MANUFACTURER OF COAL-TAR PRODUCTS • ROOFINGS • WATERPROOFING • TARVIA • CHEMICALS

Barber-Greene Line for Road Construction

MIXER

Mixes Bituminous and stabilized materials. Used as Central Plant or towed by Bucket Loader as Travel Plant. Gives accurate proportioning, thorough mixing. Continuous operation gives high capacity. Complete mechanical control of all operations produces uniform results without increasing costs. Short mixing cycle permits work in colder atmospheric temperatures, lengthening working day and season. Complete, highly portable, versatile.

FINISHER

Receives material from travel plant or truck. Gives smooth surface without the use of forms. B-G leveling principle far superior to long shoes or long wheel base. Can work to surveyed levels. Finisher levels and compacts simultaneously, thus automatically feeding correct amount of material for level *compacted* thickness. Tamping gives a permanent, more uniform density regardless of base irregularities and consequent variations in mat thickness. Tamping greatly reduces and simplifies rolling. Thickness and crown easily altered while operating, but sudden changes impossible. Foolproof.

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Valuable versatility describes the Bucket Loader. It tows the Mixer, forming the Travel Plant, picking up the aggregate from the windrow on the road and feeding it to the hopper of the Mixer Unit. It works independently, loading the aggregate from stock piles to trucks. Ideal for light stripping and excavating. It can be equipped with grizzlies or vibrating screens. Its accuracy makes it excellent for subgrade and shoulder preparation and clean-up. Rated at 2 to 3 cubic yards per minute, it is not restricted to bituminous work, but is a valuable tool all year.

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Barber-Greene Auxiliary Equipment includes Portable Driers, Clay Disintegrators, Belt Conveyors, Ditchers, Screens, Bins, Feeders, etc. Write for details. There is no obligation.

38-1

BARBER GREENE

530 West Park Avenue
AURORA, ILLINOIS

From Virgin Wilderness to the Ribbon of Finished Roadway

INTERNATIONAL

INDUSTRIAL POWER

ties in with the Achievements of the Road Builder

At Left: There are five International TracTracTors, including t with Diesel engines. The powerful Model TD-40 Diesel shown he

Above: Today there is a new line of Internatio Trucks, Half-Ton to powerful Six-Wheelers.

Above: International Diesel engine available f wheel-tractor operation in this Model TD-40

Above: The International I-12 Industrial Tract powers this maintainer.

New highway mileage of vast proportions is in prospect for America. Today, highway construction is a work of major magnitude. This year's mobilization of all forces is well under way. *New plans, new projects, new methods,* and *new equipment* are to the front.

International Harvester moves forward with this great industry, constantly building improvements into its line of International Industrial Tractors, Power Units, and Motor Trucks so that *more work is accomplished at lower costs* by the men who build and maintain the roads of the world. In addition, scores of other manufacturers combine their own special machines with our products, extending the benefits of International Harvester modern engineering and quality manufacturing.

The International Industrial Tractor line includes ten models—five wheel and five crawler types (gasoline and Diesel). International Power Units range in size up to 110 max. h.p. (gasoline and Diesel). International Trucks are built in 26 models available in 79 wheelbases to fit every hauling need. Depend on these products to solve your power and hauling problems the most economical way. For complete information, see our nearby Company-owned branch or dealer.

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180 NORTH MICHIGAN AVENUE CHICAGO, ILLINOIS

WE ADD A DASH OF COLOR to

RICHMOND FORM TIES

. . . but not to Richmond's SALES TALKS •

To save you the time and expense of hunting and measuring materials or ties for your concrete construction work, Richmond spots its different sizes and types of form-ties with distinguishing colored tags—or dips the ends of its ties in distinguishing colored paints. One glance at a Richmond form-tie—and you know immediately where and how it is to be used.

Figure out the labor and dollars and cents saving which this Richmond service affords you—add to it the fact that Richmond form-ties are carefully packed in cartons to facilitate and cut the cost of storage and selection—then add to that the inherent dependability of Richmond products—and you'll understand why more and more engineers and construction men "accept" and depend on Richmond to solve their form-tie problems.

Whatever your construction job—Richmond invites you to write in for detailed information on how you can save time, labor and money.

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JUST PRESS THE BUTTON

FOR INSTANT AIR POWER

SCHRAMM 105 DeLuxe "Utility" Compressor. Insert showing instrument panel with gauges and starting button.

WINTER STARTING HAS ITS PROBLEMS! Think what it will mean to start your compressors as quickly, easily, safely as you do your automobile. Think of the time saved, the safety to workmen and the saving in wear on your compressor. SCHRAMM "Utility" Compressors give you built-in electric starting on every size and model. No extra cost. Just push the button — SCHRAMM "UTILITY" STARTS!

Write for SCHRAMM Bulletin 3780-CJ.
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Modern Magic ...CHANGES A RIVER'S COURSE

Read this dramatic story of the part played by Shell Lubricants in the construction of the Ralston Dam

MODERN INDUSTRIAL MAGIC—that's what it takes to lead water from the west side of the Continental Divide . . . water destined by nature for the Pacific Ocean . . . through the mountains, to be stored behind the big new Ralston Creek Dam and piped into Denver, thirty miles to the east.

Shell Industrial Products played an important role in Denver's latest search for water. In the building of the big Ralston Creek earth dam and reservoir, the United Construction Company of Winona, Minnesota, used Super-Shell Gasoline, Shell "DIESELINE" and Shell Industrial Lubricants.

Their four big Diesel-powered shovels, their twenty-seven huge doughnut-tired trucks, their concrete mixers, pumps and air compressors—all operated exclusively on Shell products!

The part played by these Shell Industrial Lubricants in the building of this great project tells more than all the sales talks in the world. For construction men from coast to coast, on big jobs and small, are discovering that Shell Industrial Lubricants applied by Shell engineers . . . *pay off in results.*

Shell gives you a "plus" in lubricating values: A combination of the finest products being refined today . . . a top-notch engineering staff . . . the resourcefulness born of long and varied experience with *your* problems.

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This "plus" in lubrication is always ready to cope with your toughest problems. Simply write or telephone your nearest Shell office.

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3—Unit (nickel-manganese) car body and machinery table, totally heat treated.
4—Anti-friction bearings thruout.
5—6-cylinder power.
6—Extra large diameter swing roller-path.
7—Oversized clutches & brakes.
8—Drop forged crawler shoes.
9—Long crawlers — low bearing pressure.
10—Chain crowd with automatic adjustment.
11—Swing lock—*in any cab position.*
12—Automatic Travel lock.
13—Extra heavy cab. Plenty inside working room.
14—Fast operating speeds.
15—Two travel speeds.
16—All steel construction.
17—Three lever control.
18—E-Z clutch control.
19—High pressure lubrication thruout.
20—Safety worm boom hoist.
21—Separate hoist drums.
22—Internal swing teeth.
23—Unequalled steering at full speed.
24—Convertible—without machinery change.
25—Accessibility for inspection or adjustment.

● Shown for the first time at the Cleveland Road Show, the new Model 25, BAY CITY ½ yard shovel attracted real attention from contractors and engineers who *demand* a fast, economical and efficient power shovel that is fully convertible and a real yardage producer.

If you did not see this 25,000 lb. go-getter — a shovel with the well known powerful BAY CITY *Chain Crowd* — a shovel with *Unit Cast Alloy Construction* and *Anti-Friction Bearings* throughout — a shovel with all the many features of standard BAY CITY design based on quality and performance, write for new catalog and descriptive literature.

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BAY CITY SHOVELS, INC.

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The large photo shows an aero view of the work being done on the International Boundary line between the United States and Mexico. The smaller inset shows one of the many Sterling Pumps used on this job.

The illustration at the right shows one of the ditches to be concreted.

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As usual — Sterling Self-Priming Pumps can always be found on the BIG JOBS. Sterling dependability, ruggedness and simplicity make these pumps a favorite among contractors everywhere. Regardless of the job you have in mind—you can always depend on Sterling.

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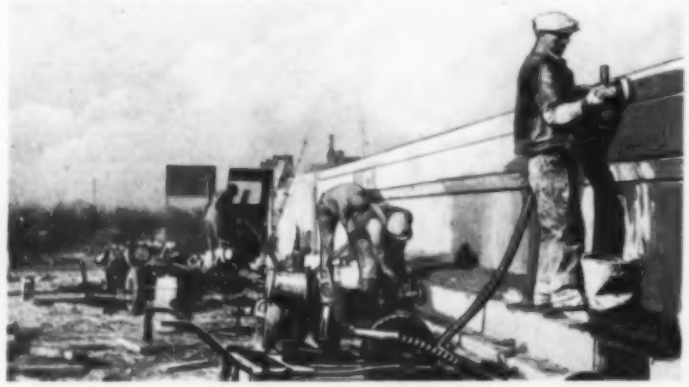
OUTSTANDINGLY DIFFERENT!

Compare Mall With All Other Concrete Vibrators



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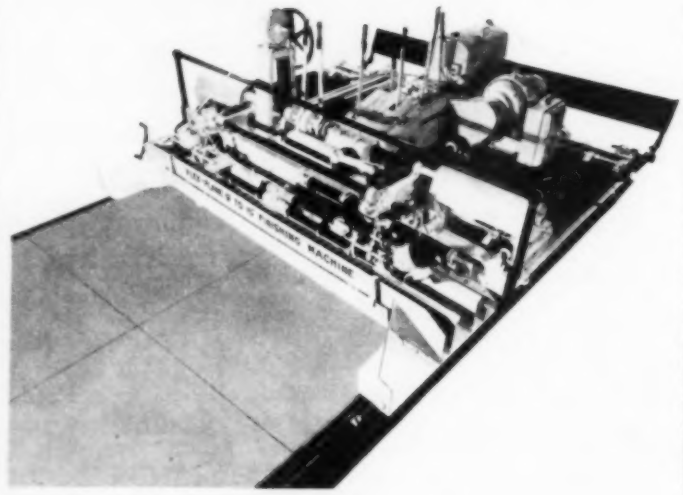
"A BIG YEAR"



A big year for "FLEX-PLANE" finishing machines, joint installing machines and dowel rod spotters is here. Please place orders as early as possible.

FLEXIBLE ROAD JOINT MACHINE CO.

WARREN • OHIO

SWINGING 10½ TONS

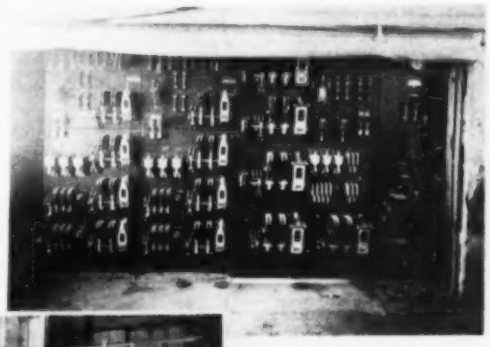
Across a Third of a Mile Span

The two 350-ton cableway towers at Conchas Dam, N. M. Propelled along a 450-ft radial track by G-E gear-motors, each tower supports a 1650-ft span that carries a full bucket of 21,000 lb. The cableways were made by the Lidgerwood Manufacturing Co. for Bent Brothers, Inc. and Griffith Company of Los Angeles, the general contractors

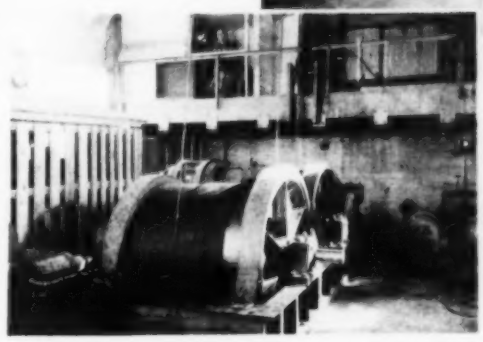
FOR swinging all types of materials across a 1650-ft. span and keeping an important job moving, the electric equipment on the cableways at Conchas Dam must be extremely dependable. It must also be flexible enough to allow for accurate jogging in lining up heavy pieces or for fast travel in carrying away earth and pouring concrete.

Unless the two cableways keep moving, little work can go on around the dam. Completely powered by G-E equipment, they are used for material handling, conveying apparatus, carrying concrete, or placing steel.

For similar tough electric jobs on *your* construction projects, you can count on G-E equipment for speedy, dependable performance. G-E engineers will be glad to help you get the electric equipment that will give you the most speed and dependability. General Electric, Schenectady, N. Y.



Control room for one of the cableway towers. The operator, equipped with headphones, controls the bucket from signals. G-E motors drive the drums



G-E a-c control panel, installed in one of the control rooms, assures accurate operation of the bucket over a wide range of operating requirements

GENERAL ELECTRIC

Again! GOODALL RUBBER *for the Seals!*

ABOVE: *Section of Rubber Center Seals. These Seals are 30'6"x 15"x 1¾".*

LEFT: *Section of Rubber Side and Bottom Seals, each 30'6"x 4⅛"x 1¾".*

PROJECT: *Lock in Chicago River at Lake Michigan, for the Chicago River Control Works.*

GOODALL

furnished the Rubber Seals for the four steel gates of the giant Chicago River—Lake Michigan Control Lock. These Seals are unique in design and construction, and are made from the toughest, high-quality stock it is possible to incorporate in a finished product.

The gates into which the Seals were built have a total weight of 900,000 lbs. They are triangular in shape, 48 feet wide and 30 feet, 5½ inches high.

Designers: Sanitary District of Chicago, Engineering Department.

General Contractors: Frazier-Davis Construction Co., and G. L. Tarlton Contractors, Inc.

Steel Fabrication by Bethlehem Steel Corporation.

GOODALL has furnished a large percentage of the Rubber Seals used on Government locks and dams throughout the country. The project described above is further evidence of the confidence placed in GOODALL *quality* by the Nation's leading engineers and contractors.

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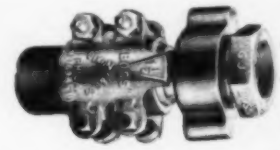
BETTER PERFORMANCE LONGER SERVICE ON ANY JOB

"DIXON" AIR HAMMER COUPLINGS

Designed and built to withstand the continual vibration of hand hammers and rock drills, this Dixon coupling has a longer, consistently economical service life on the toughest job. And, like the "Boss," it is rust-proofed by Cadmium Plating.

"BOSS" HOSE COUPLINGS



Used for steam hose, steam hammers, air, hydraulic or road builders' hose . . . "Boss" Couplings have no equal for dependability in service. Parts are of steel or malleable iron to withstand abuse . . . Cadmium Plated for rust proofing.

Furnished in Washer or Ground Joint Type.

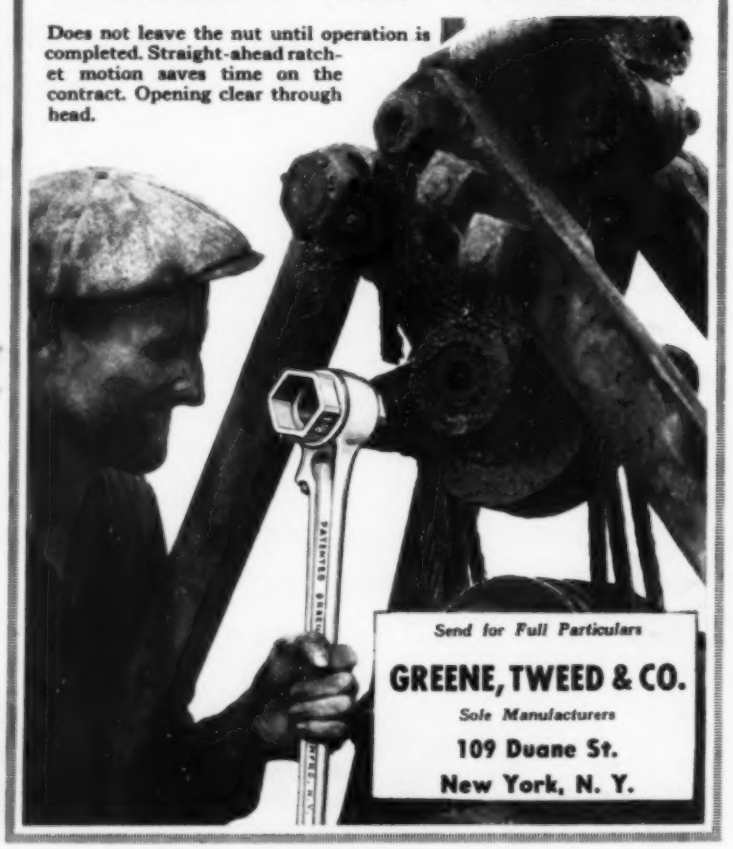
DIXON
VALVE & COUPLING CO.

LOS ANGELES PHILADELPHIA HOUSTON

Carried in Stock by Leading Rubber Manufacturers and Jobbers.

NUTS MUST BE ABSOLUTELY TIGHT On This Kind Of Equipment USE THE FAVORITE REVERSIBLE RATCHET WRENCH

Does not leave the nut until operation is completed. Straight-ahead ratchet motion saves time on the contract. Opening clear through head.



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Chips bored from sample ingot are analyzed while the heat is still in progress.

IS THE START IN BUILDING WICKWIRE ROPE LIFE "BEYOND SPECIFICATIONS"

Official Specifications only set minimum physical standards. It is still the privilege of the progressive rope manufacturer to build life beyond specifications into his product.

Sampling . . . Sampling . . . Sampling and then more Sampling . . . several times during every heat . . . day in, day out for the entire 24 hour span. It is the only way that steel can be checked and corrected to produce the kind of wire to meet Wickwire Spencer requirements for building life into Wire Rope beyond specifications.

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WICKWIRE SPENCER STEEL COMPANY

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THESE WRENCH TESTS ASTOUNDED OUR ENGINEERS!

● So surprising were the strengths revealed in careful tests of Williams' "Superior" Wrenches, that our engineers at first questioned their own findings. Such performance, as indicated by these tests, had never been associated previously with Carbon Steel wrenches. But developments in metallurgy, coupled with advances in manufacturing methods, have enabled Williams' engineers to produce an Improved Carbon Steel Wrench approximately *twice as strong* as old-fashioned wrenches of this type.

Drop-forged from improved quality carbon steel and specially processed to Williams' exacting specifications, "Superior" Wrenches average *93% as strong as Alloy Steel Wrenches of similar size.* They are actually stronger than the Double Head Engineers' Pattern alloy wrenches which are of popular thin design. They cost considerably less! They provide a better hand grip than the usual thin alloy wrench . . . they insure greater and safer bearing on the nut. Make your next wrenches Williams' "Superiors". . . available in 50 patterns, over 1000 sizes.

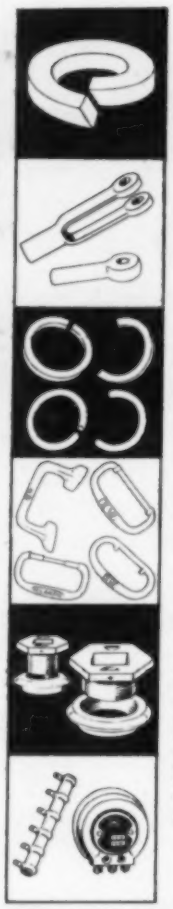
J. H. WILLIAMS & CO.

2 Spring Street, New York

Headquarters for: Drop-Forged Wrenches (Carbon and Alloy), Detachable Socket Wrenches, Reversible Ratchet Wrenches, "C" Clamps, Lathe Dogs, Tool Holders, Eye Bolts, Hoist Hooks, Thumb Nuts and Screws, Chain Pipe Tongs, Vises, etc. 1-479

Get this FREE BOOKLET

Every mechanic and tool buyer needs this helpful, informative booklet. Complete tables give correct wrench opening for U. S., S. A. E., American Standard Nut and Cap Screw sizes. Data on wrench types and applications, how to select the proper wrench for your needs. Write your name and address in margin below, tear off on dotted line and mail.



SPRING WASHERS

Spring washers and lock washers of every type and size, including the well-known Hipower and Kantlink types. There are thousands of more places where spring washers would improve the value of any product where bolts, nuts, cap or machine screws are used.

STEEL ROD ENDS

Drop forgings including steel rod ends of the adjustable yoke, plain yoke, and eye types. These articles in standard sizes and threads afford tremendous savings over special designs.

RETAINING RINGS

Spring retaining rings of special heat-treated spring steel are carried in many stock sizes—both open and closed types. Use of a spring retaining ring is an excellent manner of creating a shoulder on a shaft.

CONTAINER HANDLES

Forged steel handles for heavy containers—can be rigidly welded, riveted or attached by a strap to lie flat when not in use. Rugged and most satisfactory for hard usage.

STEEL BARREL CLOSURES

Forged and machined fittings for steel barrels, drums, tanks and metal packages, including plugs, rings and flanges. Very rugged for use in transportation of alcohol, turpentine, oils and other expensive liquids.

RHEOSTATS—RESISTORS—LOAD BOXES AND SPECIAL APPARATUS

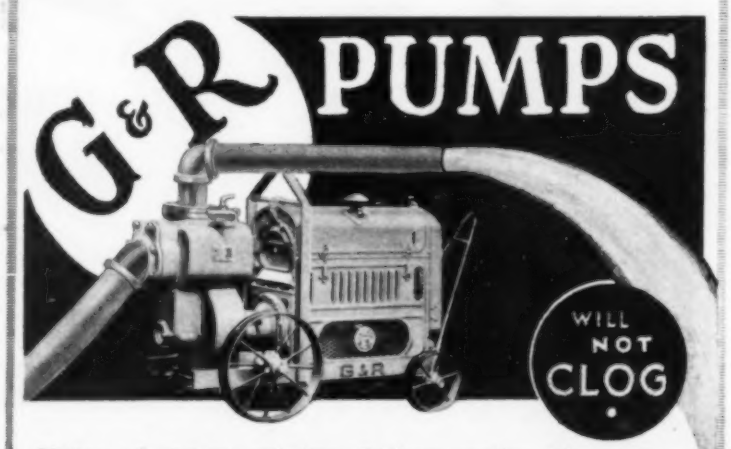
Our electrical division—Hardwick, Hindle, Inc.—makes as fine electrical resistance products, fixed and variable, as can be devised.

Other products include windows for buses and railway cars, railway car window curtains, curtain rollers and fixtures, sash locks and lifts.

THE NATIONAL LOCK WASHER COMPANY

NEWARK, N.J. – EXPORT DIV., 15 E. 26 St., N.Y.C.

G & R PUMPS



Claims of fastest priming, highest suction lift, more gallons per minute, etc., *do not pump water.* On the job, the pump must do its own talking, and with dirty water, many a pump is inclined to stutter—and stop.

Let G & R Pumps tell you their own story on any job. They will deliver as much, and usually more, water *under any condition,* than any other pump. We will ship you one and let you be the judge.

Remember this about G & R Pumps — THEY WILL NOT CLOG — THEY ASK NO TIME OUT. Play safe! Try a G & R Self-priming Centrifugal before you buy any pump this year.

Distributors in 100 principal cities are ready to make prompt delivery of the G & R Pumps you need.

The Most DEPENDABLE Pump for The Least Money

THE GORMAN-RUPP CO. Mansfield, Ohio

THE QUICKEST WAY TO INCREASE TRUCK PROFITS IS TO REDUCE TIRE EXPENSE!

● General Truck Tires have always been built stronger... to do their work better... deliver greater mileage and haul more payload.

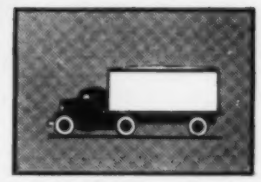
It costs more to build a General, but thousands of truck operators know it costs less to use Generals.

See your General Tire dealer. He may be able to reduce your tire costs materially.

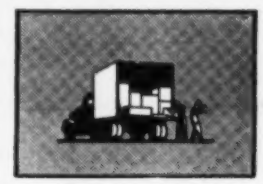
THE GENERAL TIRE & RUBBER COMPANY • Akron, O.

In Canada–The General Tire and Rubber Company of Canada, Limited, Toronto, Ontario

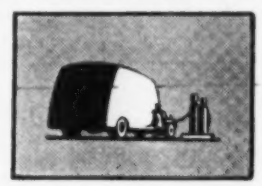
Transit-Mix Concrete Corp., New York City, operate 75 trucks and have selected Generals "on performance."



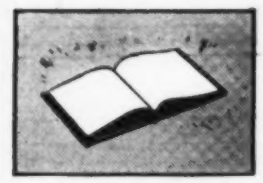
Every one of your trucks must be regarded as a profit producer. The profit consists of whatever part of your dollar is left after all expenses are paid.



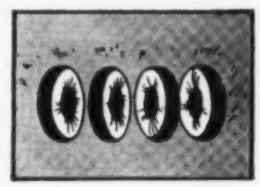
Labor, the biggest item, is fixed. Nothing much can be done about it.



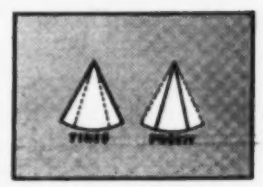
Gasoline and oil take a big slice of your dollar and the possibility of reduction is small.



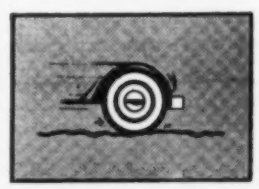
Depreciation and mechanical maintenance take another big slice of your dollar that offers small opportunity for improvement.



Tires take their slice and the balance, if any, is profit.



Of all the items that enter into expense, the tire item is the most flexible. It is the *only one* that can easily and quickly be reduced and as it is reduced the profit slice of your dollar is increased.



How can you decrease tire costs? Use the best tires you can buy and take good care of them.

And what is "best"? To General it means *physical carcass strength* to meet the battering of the road and to carry heavy loads. *Elasticity–flexibility–smooth action*–to offset heat that weakens and ultimately blows out your tires and increases tire expense at the sacrifice of profit. *Resistance* to wear that scrapes off the tread of your tires and needlessly steals part of your profit.

GENERAL TRUCK TIRES

"Moved 1550 yards-in a single day-on a 1000 foot haul..." in Georgia

On job after job, the Austin-Western 5-Yard Scraper lives up to its reputation for earning the highest return per dollar invested of any scraper on the market. In a recent letter commenting on his experience with two of these fast stepping A-W Scrapers, Mr. V. L. Bearl, Hart County Grade Foreman, says:

"I have been doing grade work for fifteen years and I have never yet seen anything that will in any way equal your 5-Yard Single Cable Scraper with its ease of handling and its ability to fit into any place.

"We hardly ever have to plow up ground for the scrapers unless it is a very hard old road bed or very hard rock. These scrapers cut soft rock almost as easily as dirt. I had a haul today of about a 1,000-foot distance and I moved 1550 yards of dirt."

This extraordinary capacity is largely due to the easy, positive means used by the Austin-Western 5-Yard Scraper to simplify and speed up digging,

carrying and spreading. When scraper digs, pan floor is level with ground—all wheels track inside of cutting edge . . . Ability to make 180° turns, permits quick return from dump and easy handling. Operator can dump the entire load . . . or spread it to any depth up to nine inches . . while traveling at full speed ahead.

Electric welded construction assures

THE AUSTIN•WES RN

S RN ROAD MACHINERY CO. AURORA, ILL.

long, low-cost life and ability to withstand hard usage. Single cable, operating from winch on tractor, controls all operations. 35-40 h. p. tractor is ample power under normal working conditions. Write for complete engineering data and performance records on these 5-Yard Scrapers. They're LOW IN FIRST COST, and economical in operation.

THE AUSTIN-WESTERN ROAD MACHINERY CO.
AURORA, ILLINOIS

AUSTIN-WESTERN

The Austin-Western Road Machinery Co., 1814 Barrows St., Aurora, Ill.
Tell me more about the A-W 5-Yard Tractor Scraper and its extraordinary dirt moving capacity.

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Address.....

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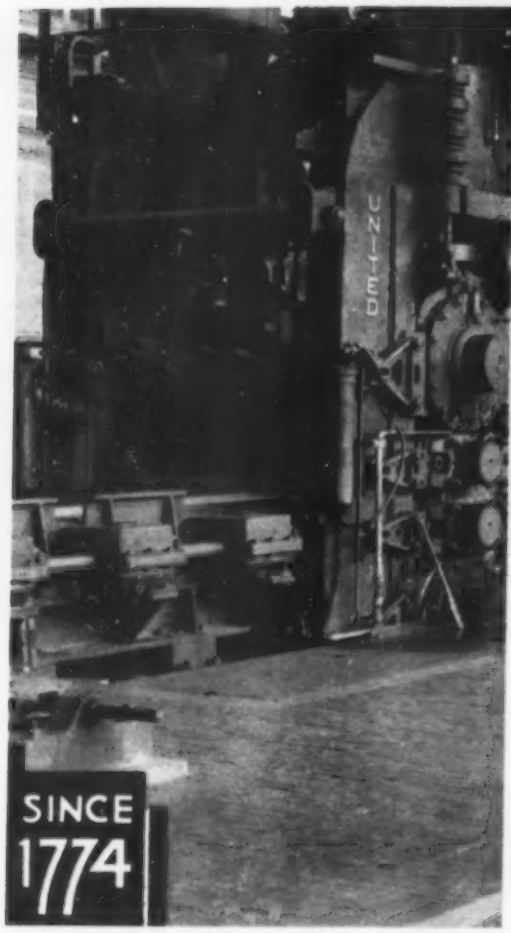
THERE'S NOTHING LIKE EXPERIENCE



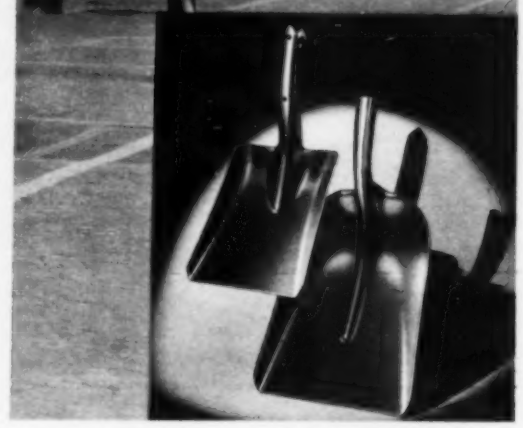
Shovel Steel

"I've been handling shovels a long time, and I'm telling you that the ABW Shovels have the best steel in them of any shovels made. I didn't know why, until one time I asked about the steel and here's what they told me:

"It seems that the quality of steel is determined by the process. It also seems that the most modern way of rolling steel is by the Continuous Rolling Process, but no shovel steel had ever been made this way.

"Well, the Boss down at ABW got the idea they could make better shovel steel by the Continuous Rolling Process and the result is that ABW was the first, and I guess the only one to use steel rolled by the continuous process for shovel blades—and that's what makes them better. You don't need to take my word for it—just do a little investigatin' and experimentin' for yourself."

Yes, ABW was the first and is the only manufacturer of shovels to use this superior steel for shovel blades. No reused stock ever finds its way into ABW shovel blades—only fresh steel is used. This special process produces steel that is tougher, has a better grain structure and is more uniform. When you sell ABW Shovels—you sell the best.



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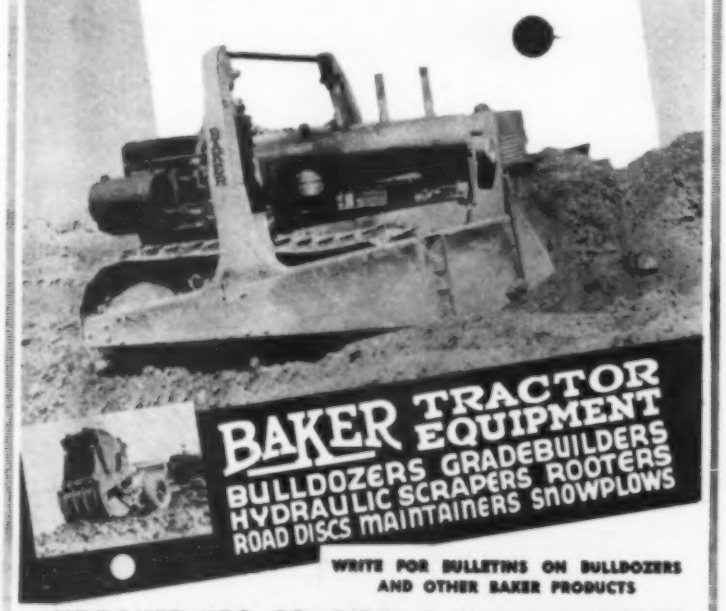

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BULLDOZERS GRADEBUILDERS
HYDRAULIC SCRAPERS ROOTERS
ROAD DISCS MAINTAINERS SNOWPLOWS

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THE BAKER MFG. CO., 568 Stanford Ave., Springfield, Ill.

A New Portable
BITUMINOUS
MIXING PLANT

FOR MODERN ROADWORK

. . . at Low Cost

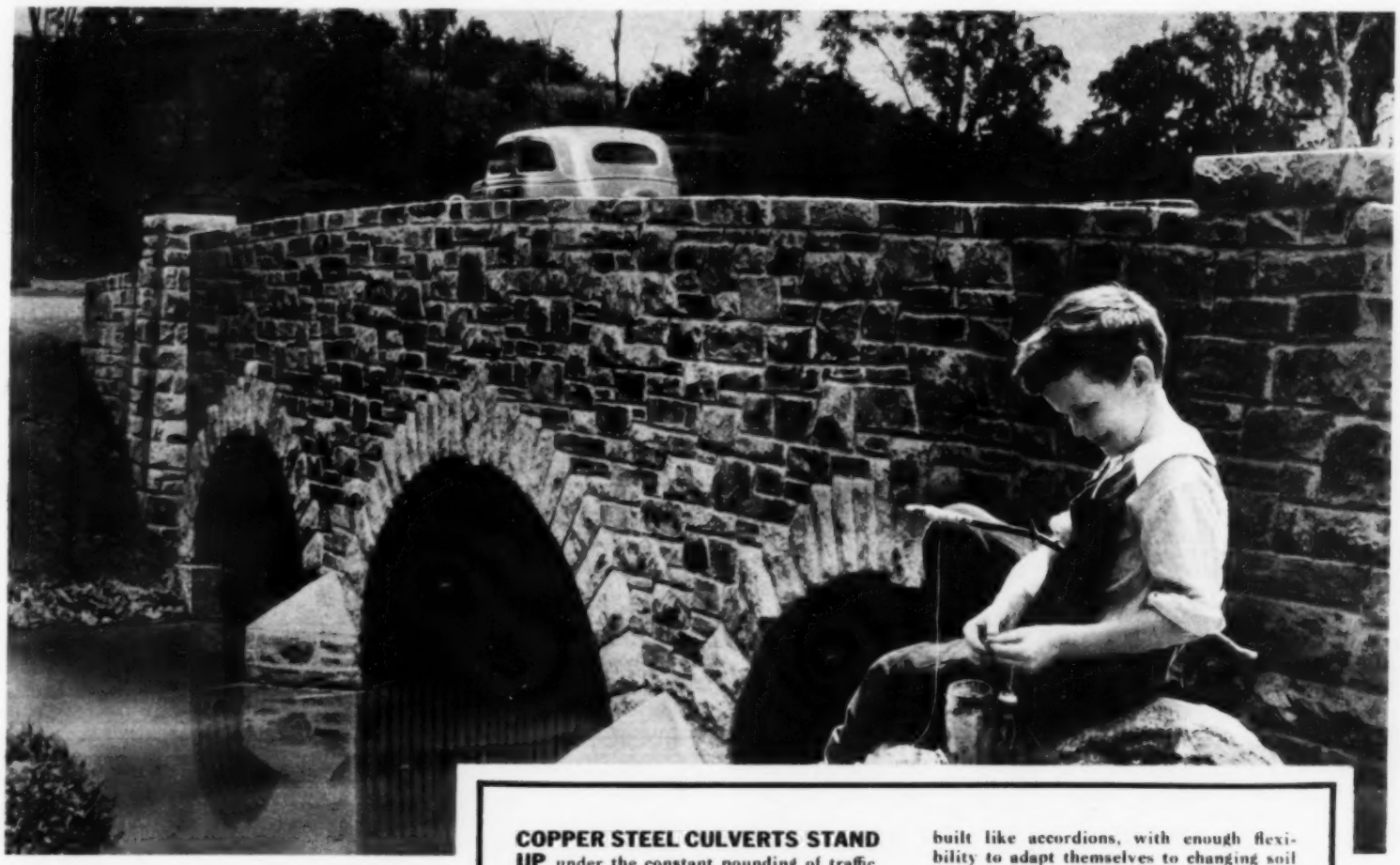
This plant was designed to meet the demand for the economical improvement of secondary roads. We have built several to date and they have proved their worth in actual service. No investment is needed for a running gear, plant adapted to standard flat bed truck and trailer hauling.

Some Details

- Can be erected by 3 or 4 men in a few days.
- No erection equipment required. Plant equipped with hoist and jib crane.
- Built in 2 units (dryer unit; and screening and mixing unit).
- Comply with most highway loading and clearance regulations.
- SKF bearings throughout. Fully enclosed vibrating screen. Steam-jacketed, steam-operated steel mixer. Large combustion chamber and dust collector.
- Write for Bulletin T-250.

HETHERINGTON & BERNER, INC.
701-745 Kentucky Avenue Indianapolis, Ind.

Why Copper Steel is the *Right* Material for Culverts



COPPER STEEL CULVERTS STAND UP under the constant pounding of traffic. The corrugations form strong repeated arches capable of carrying heavy loads.

COPPER STEEL RESISTS CORROSION. Countless installations and numerous tests conducted by independent testing laboratories show that U·S·S Copper Steel has the highest atmospheric corrosion resistance of any commercial culvert metals.

NO CRACKING OR BREAKING from shifts in sub-soil. Corrugated culverts are built like accordions, with enough flexibility to adapt themselves to changing soil pressures without failure.

TRAFFIC INTERRUPTIONS CAN BE PREVENTED. Copper Steel culverts are installed quickly and easily, often without stopping traffic. The result is substantial savings in time and labor costs.

LOW INSTALLATION COST. Copper Steel culverts eliminate much expensive foundation and form work, can be handled with fewer men and do not require highly skilled labor.

PERFORMANCE is the main objective in culvert installation—and the story of U·S·S Copper Steel is one of better performance at lower cost. The most convincing evidence of this is the fact that no culvert made of U·S·S Copper Steel has ever been known to fail structurally in service.

Copper Steel culverts are designed to resist such forces as sudden freezes, rapid thaws, sub-soil changes, heavy weight and vibration. They do not crack or fail under stresses that might destroy rigid materials.

Another strong advantage of U·S·S Copper Steel is its endurance. In 1911 U. S. Steel engineers discovered that a little copper added to steel more than doubles its resistance to rust and atmospheric corrosion under alternate wet and dry conditions. When galvanized, U·S·S Copper Steel has proved over a period of years to be a most enduring, low-cost culvert material.

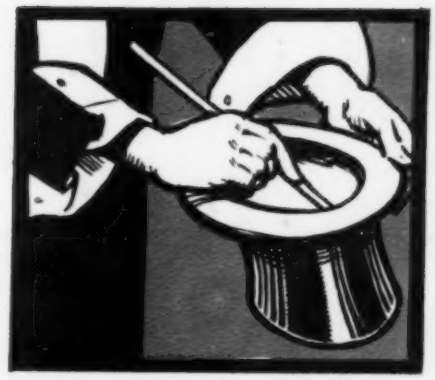
U·S·S COPPER STEEL GALVANIZED SHEETS

CARNEGIE-ILLINOIS STEEL CORPORATION, *Pittsburgh and Chicago*
COLUMBIA STEEL COMPANY, *San Francisco*
TENNESSEE COAL, IRON & RAILROAD COMPANY, *Birmingham*

United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

Magic?



NO — JUST COMMON SENSE!

● Users stress the simplicity and reliability of Speed-o-Matic hydraulic-pressure control. Where they had thought a complicated set-up necessary for its amazing results, they found merely a simple, practical, natural method of transferring the back-breaking effort of manipulating mechanical levers from the operator to the power of the machine itself. It increases digging speeds from 25% to 60%, which result in corresponding yardage increases.

Link-Belt Company, 300 W. Pershing Road, Chicago. Distributors and Offices in Principal Cities.

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LINK-BELT

Speed-o-Matic SHOVEL

DRAGLINE - CRANE

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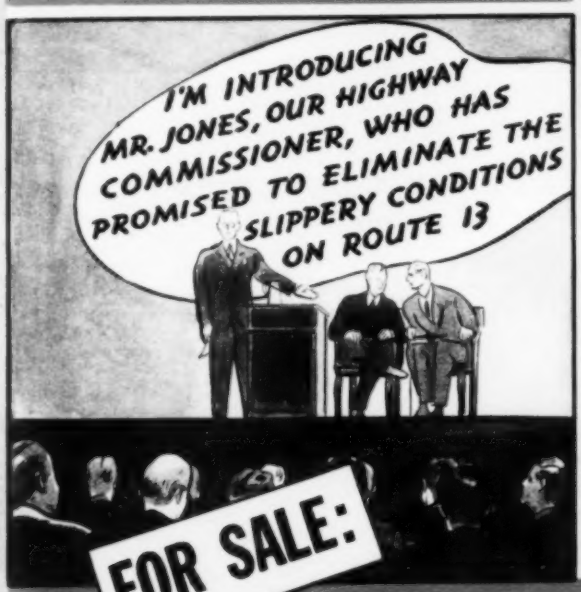
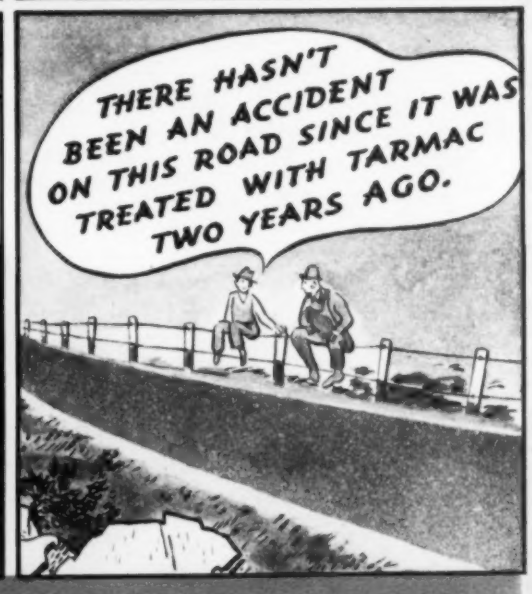

I'M INTRODUCING MR. JONES, OUR HIGHWAY COMMISSIONER, WHO HAS PROMISED TO ELIMINATE THE SLIPPERY CONDITIONS ON ROUTE 13
FOR SALE:



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Thus Cordeau-Bickford, the insensitive detonating fuse, detonates *each* and *every* cartridge in the hole. This results in more power from your explosives, for the entire charge "goes" with the added force of a primer cartridge.

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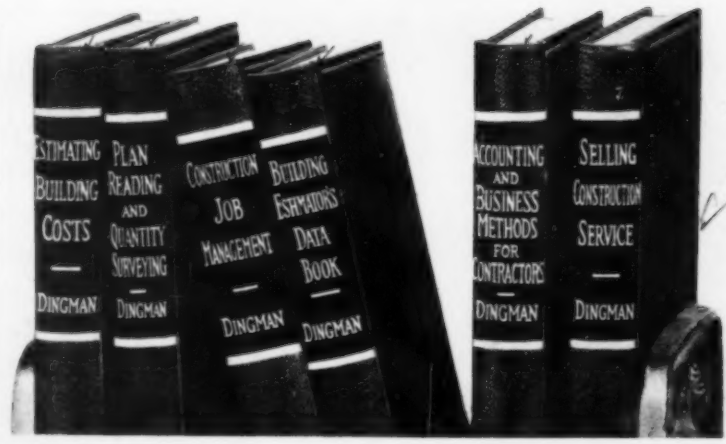
THE ENSIGN-BICKFORD CO. • SIMSBURY, CONN.



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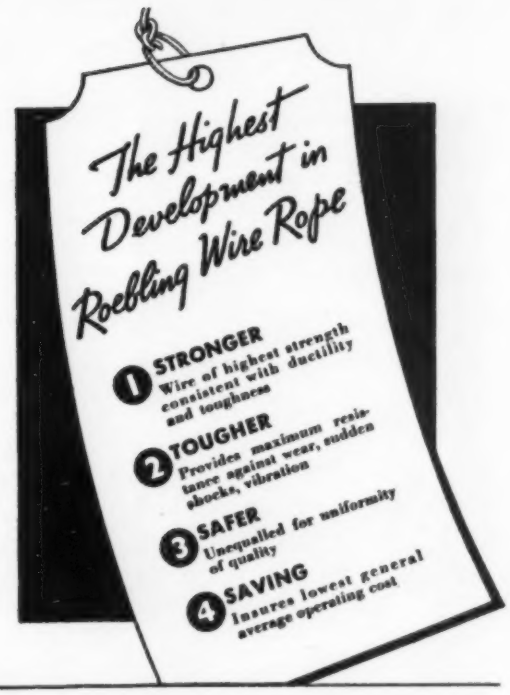
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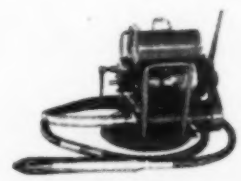
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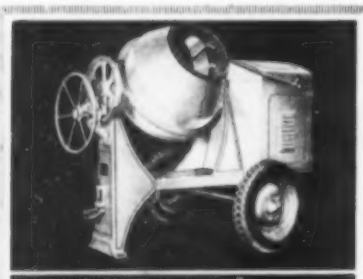
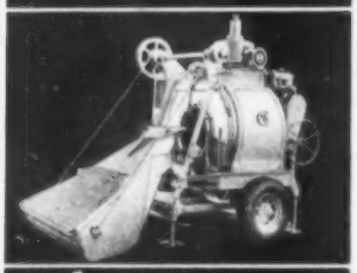
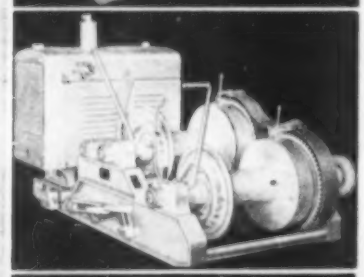

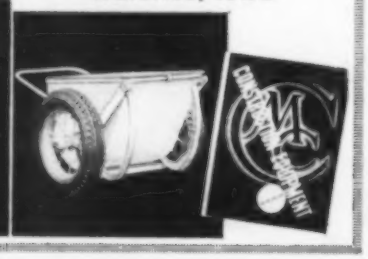

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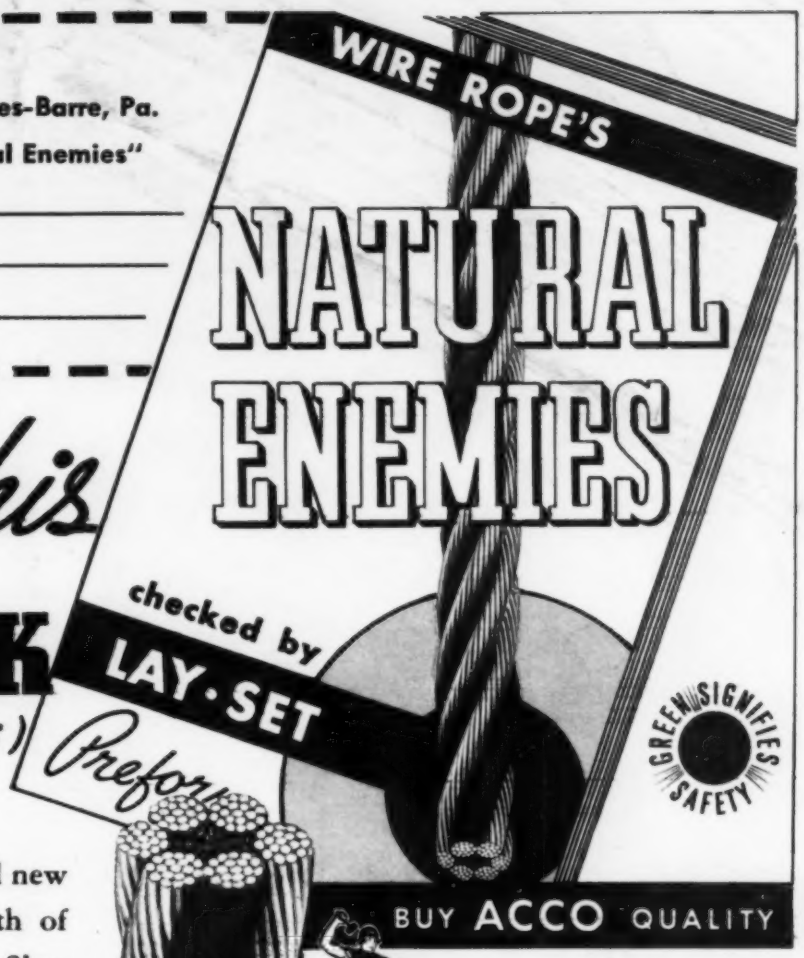

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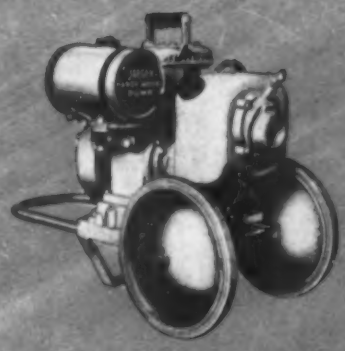

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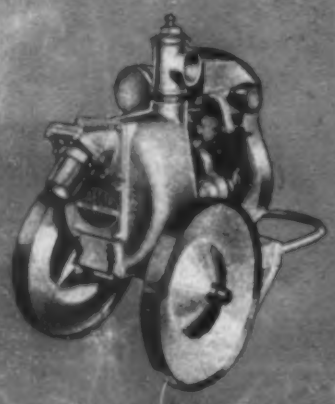

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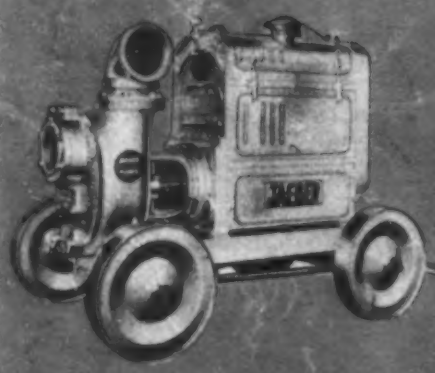

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